imiting Short-Circuit Currents in Alternators—Small-City Street Light-
g Units—The second of a series devoted to street illumination for small towns and cities

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War and Labor

IT IS time the American people fully awoke to the fact that their country is in a war of the first magnitude, and that conditions of business and of labor will undergo profound changes which are already beginning. Unless preparations are made to meet such changes, we shall find ourselves soon in a very unpleasant situation. The effect of the war on the labor situation is likely to be especially serious. Even now there is trouble enough, and presently we must prepare for more. A million and a half men are now being put under arms. This in itself is no serious drain on the country. We lose that number out of the active life of the country every summer, on vacations and otherwise, without realizing the small percentage of loss. But at the present stage of the war it takes about four men at home to keep one man of the fighting force supplied. The ratio early in the war was a little smaller than this, but the enormous use of artillery has brought it to the present figure. Further, only 25 or 30 per cent of the fighting force can be kept on the fighting line; the rest are in the rear, resting, or engaged in various tasks of construction and transportation far back of the trenches.

If we are to put and keep even a million men at the front, a number which may readily prove entirely inadequate to the needs of the crisis, then we must reckon on not less than twelve million engaged in one way or another directly in the tasks of war at home or abroad. This is more than a quarter of the nation's working force; hence, if there ever was a time in the history of industry when the most determined efforts should be made to push production by the aid of every labor-saving device that ingenuity can suggest, that time is now. To keep up the necessary war work not only must a great force of workmen be deflected from other pursuits, but they must have every possible facility to increase the individual output. Factories must be equipped with this chiefly in view, so that mechanism may be made to do a greater share than ever before. This is doubly important, for the reason that it is virtually certain that conditions will call for the employment of a very largely increased number of women, whose lack of brute strength must be compensated for by mechanical aids. As we pointed out some time since, the situation is not one of "business as usual," which is simply a fool's paradise, inviting the devil to break in, but business as unusual, in which every effort must be made to accommodate the industrial situation to real and not to fancied necessities. Between war materials and the huge task of feeding ourselves and the Allies, so large a proportion of our labor is necessarily employed that other things will have to go by the board except in so far as industry and ingenuity can make one man approach as nearly as may be to doing the work of three. The hour to prepare for this rearrangement of labor and for the intensive use of labor-saving devices is right now.

Street Illuminants

JAMES R. CRAVATH'S article in this issue on the characteristics of illuminants for street use gives a thoroughly up-to-date view of the present situation. At the present moment the sources of real competition for street-lighting purposes are the gas-filled tungsten lamps and the magnetite arcs. Mr. Cravath is quite right in regarding the inclosed carbon arc as practically of only historic interest. We wish that we might say that all extant specimens of this lamp were reposing in collections of old apparatus, instead of being on the street; but in point of fact many thousands are still in use, although practically obsolescent. As regards the flame carbon arc, the case is somewhat different, inasmuch as the influences which have caused its decreasing use have not been inherent but external and accidental. A well-designed flame carbon arc is today so much more efficient in lumens per watt than any other form of illuminant that it would well hold its own had it been possible to bring the lamp in this country to the point of usefulness reached abroad. As a matter of fact, things were going very well with it up to about the time the war broke out, when the natural disturbance of affairs prevented the usual adjustment that takes place between foreign and domestic engineering problems. The difficulty with the globes to which Mr. Cravath refers has been a minor consideration in change of practice, but he is quite right in classifying the flame carbon lamp as on the downward road at present.

The balance between the incandescent and arc lamps at the present day is one not easy to strike. It is a question of the particular lighting problem to be solved, density of service, cost of energy, and the preference of the community and the electric lighting company for one or the other illuminant. Where powerful sources of light are required by the conditions, the arc lamps maintain an advantage in efficiency, and in common estimation in color also, that enables them easily to hold their own, while for general service the incandescent lamps present the advantage of sources of moderate power and yet very good efficiency, so that owing to the advantages of subdivision better lighting can be had by their use than with arcs. Diffusing and redistributing glassware is a useful addition to both,

although the smaller sizes of incandescent lamps are, for economical reasons, not generally so equipped. The main practical difficulty with incandescent lamps seems to be a strong tendency of bulbs to blacken, a tendency much less marked now than in the early days of the gas-filled lamp, but still troublesome, and particularly noticeable in the otherwise very useful incandescents of rather large power inclosed in glassware. By day these may come to present the appearance of a blackish smudge even before the actual light-giving power has been very seriously reduced. It requires vigilance and energy at present to overcome this difficulty, but on the whole the results are very satisfactory.

Give Electrical Contractors Their Due

IN THIS issue we publish two articles which bring into bold relief the policy adopted toward electrical contractors by the government in the great program of cantonment construction now drawing to a close. One, by Colonel Littell, expounds the policy of the Quartermaster's Department on various points, including the one of sub-contracts, which touches so closely the industry of the electrical contractors. The other article, by L. K. Comstock, tells the experiences of a committee of electrical contractors in trying to be of service in cantonment construction. Such service was barred because of the opposition of authorities to sub-contracts. This raises an interesting question of procedure, not because of cantonment construction, for that is past; but for the reason that it may involve future government attitude and the welfare of the electrical contracting industry. If this were a single isolated case, a mere question of military expediency without a long train of possible consequences, it would lack serious importance. It would be set down as an instance where decisions had to be made in haste and somebody's toes had to suffer. But in reality the aggregate work on the cantonments was very large.

It is never a slight thing to disturb the normal channels of trade. In ordinary construction the electrical work is handled by electrical contractors because they are better qualified than any other agency to do the work as it should be done. They are best qualified to do it economically and to do it well. Long experience with men and materials, training in actual construction, knowledge of markets, organization, responsibility are qualifications which the electrical contractors of recognized standing present. Keen in competition, close in bidding, they do the overwhelming bulk of the work in ordinary times. The fact that we are at war makes their skill not less valuable; it makes them more useful wherever there is work to be done of the kind that they are by efficiency best fitted to do.

We believe that the general policy of our government is to use, as far as possible, the existing avenues of trade where they are proved to be the best adapted for the purpose in hand. This policy, we submit, calls for the employment of electrical contractors. They are specialists; they have developed themselves and their organizations to render effective service along lines which call for technical ability. They are in every way anxious to be of use. We believe that they will be as patriotically ready as any other commercial agency in the country to do what they can. It is a time of historic crisis. They want to have the same part that others have. They are fairly entitled to it.

Engineering a Shift in Coal Supply

A BRIEF paper in our columns gives an account of the very ingenious and successful methods by which the Milwaukee Electric Railway & Light Company has dealt with a change in coal supply. Previously it had been receiving its coal from the Eastern coal districts by water, unloaded at a convenient yard and then moved to the power house along the river on a special self-unloading barge. Now the coal supply comes by rail, and provision had to be made for getting this coal to the power house with the minimum possible trouble. The layout of the new coal-handling plant was determined with reference to the conditions and machinery previously existing, with the pleasant result that all the equipment of the old plant has gone into the new, and the coal supply has been shifted at a minimum cost to meet the new conditions.

Shifting Underground Cables

THAT underground cable work is getting every year upon a sounder and sounder basis is put strongly in evidence by the success of the Commonwealth Edison Company of Chicago in dealing with the problems of shifting old cables from one location to another. It has rather commonly been the notion that pulling long-used cable out of one duct and laying it in another is a very serious undertaking, likely to lead to trouble. At the present time the cost of cable is so great that when new conditions of distribution change the requirements of the underground conductors it is worth while to utilize every foot of usable cable wherever it can be of the most service. The engineers of the Commonwealth company have tackled the job very successfully, so that they are now moving about 75 miles (120.7 km.) of old cable, some of it in use for twenty years, and apparently are making an extremely good job of it. It is found that so long as the lead sheath is in good condition and the insulation undamaged, cable can be drawn out and shifted to a fresh position of usefulness without very serious difficulty. In removing old joints and sealing the ends preparatory to the shift, the condition of the insulation can be determined, and careful inspection will avoid faults with the lead sheath.

One of the very ingenious details of the work is a thorough record keeping of the lengths of cable, together with their respective places, including cable likely to be released by future changes. By filing the pieces of cable according to the length, wastage in shifting can be greatly reduced. It becomes possible readily

to pick out pieces that would fit into the new situation without waste. Further to reduce waste, splices are being pulled into the ducts, a long piece being drawn in until enough is left outside to splice; then the necessary shorter piece is spliced on, with a somewhat smaller lead sleeve than usual, and drawn in, a procedure which relieves the tension in drawing. So far it appears that hardly more than 2 per cent above ordinary wastage has been lost, although as the number of pieces to select from grows smaller this proportion may slightly increase. The net result is that 75 miles of cable will be restored to long-continued usefulness which otherwise would probably have been sold for junk.

Limiting Alternator Short-Circuit Currents

WHEN a large central-station alternator, say of the turbine-driven type, is running under rated load in normal operation, a steady stream of energy is passing through the machine at a great rate. It enters as mechanical power at the shaft, in torque times angular velocity, and leaves as electrical power at the terminals, in voltage times current. The electrical conductors in the machine easily carry the normal mechanical and electrical stresses involved in this steady performance of duty. If, however, a heavy short circuit occurs, say on the feeder system, not far from the station, the electromotive force generated in the armature tends to send through the short a current perhaps hundreds of times the normal strength. The enormous output of current and power may develop disastrous effects in the feeder system, but unless they are instantly checked, the corresponding stresses inside the alternator delivering the short-circuit current may also be so great as to wreck the machine mechanically as well as electrically.

To protect both the alternator and the system from the possible effects of severe shorts, automatic circuit breakers are installed which will promptly open the alternator circuits close to the terminals. Even with such apparatus installed, it may happen that, either by overload of the circuit breakers or before they can operate, the stresses on the alternator may be too severe to be endured safely, especially when several alternators are operating in parallel on the same set of busbars. Large reactors are therefore frequently installed between the alternators and the external system, or between different sections of that system, so that in case of heavy shorts they may automatically set a fairly safe limit to the strength of the short-circuit currents, independently of and also in support of the circuit-breakers. These reactors are reliable, but they are bulky and awkward devices. They also interfere to some extent with the regulation and efficiency of the system.

In an article in this issue Ralph Bown suggests that something can be done to limit the violence of a short by inserting additional resistance or reactance, or both, in the field circuit, instead of in the armature circuits, of an alternator. The suggestion is based upon experiments made with a comparatively small polyphase alternator, capable of delivering some 1300 amp. peak current on immediate short circuit in one phase. The effect of adding 2.5 henries of external inductance in the field circuit reduced this instantaneous peak current to 1000 amp.

Just how far the suggestion could be practically utilized in central station practice is a question for detailed consideration by alternator designers, with the aid of experimental tests. There is, of course, a very distinct disadvantage in loading the alternator field circuit with extra resistance and reactance. The benefits capable of being secured in this way would have to be sufficiently great to overcome this disadvantage. Different types of machine would be likely to respond in different degrees to this type of protective modification.

Apart from the question of practical serviceability, the article is useful in presenting a simple qualitative theory of some of the salient transient phenomena occurring in an alternator during the first few cycles after a sudden short circuit. The theory is supported by the oscillographic evidence.

It is well known that when an alternator is running steadily under any normal assigned set of conditions the armature behaves as though it possessed a certain reactance, commonly called the "synchronous reactance." This synchronous reactance is partly due to the inductive reactance of the armature, and partly to armature reaction on the rotating magnetic field. On the occurrence of a short circuit the armature current is, unfortunately, not limited by the value of the synchronous reactance but by the value of the much smaller inductive reactance. After the expiration of a certain number of cycles the shorted alternator settles down to a new condition, in which the effective reactance is more nearly equal to the synchronous value. It is just during these first and particularly dangerous few cycles that the internal actions of the machine are relatively difficult to apprehend, and the article throws light upon this subject.

The Coming Issues

WITH the tendency toward concentration of power generation and the growing use of electric furnaces it has become especially important that the stresses which will be exerted between busbars on short circuit be accurately predetermined in order that they may be properly supported. This subject will be taken up in a very clear manner in the next issue by H. B. Dwight. Some of the problems involved in operating alternators in parallel and what precautions should be taken to prevent "phase swinging" will be discussed in another article. The third article in the series by James R. Cravath devoted to street lighting for small cities will be confined to poles and lamp supports, with consideration given to both overhead and underground construction.

Changing from Eastern to Central States Coal

How the Coal-Handling Equipment and Facilities of a Middle Western Company Were Rearranged and Augmented to Permit Receiving Coal by Rail Instead of by Water Without Losing the Value of Existing Equipment

THE Milwaukee (Wis.) Electric Railway & Light Company found it necessary to considerably revise its coal-handling facilities incident to the substitution of coal from the central part of the United States for coal formerly received from the so-called Eastern district. Due to this change provision had to be made for facilities to receive the coal by rail instead of by water routes, so a new water-side coal yard was erected to store the coal, crush it and deliver it to a specially constructed self-unloading barge designed to deliver coal to the company's power plants. The coal-handling scheme is especially interesting because the methods which were adopted have permitted the company to utilize every piece of equipment which it employed in its former plant. No equipment was scrapped.

Under the old system coal was received by way of the Great Lakes, unloaded and stored in a local coal company's yard, then moved to the power houses on the self-unloading barge. The first problem under the new system was to find a water-side yard large enough to accommodate the storage coal and necessary handling equipment. For this purpose the company vacated its 680-ft. by 280-ft. (207.26-m. by 85.34-m.) general storage yard on the Kinnickinnic River. The yard lies with one of its short sides along the waterfront, and is surrounded by sites already occupied by local industrial plants. For this reason the economical use of the 190,400 sq. ft. (17,750 sq. m.) of space available was especially important.

When coal arrives at the yard it may take one of two courses: it may be unloaded by either of the two electric locomotive cranes and stored in the yard, or it may be taken immediately to a 1500-ton (13500-t.) bunker for filling barges which will transport it to the power

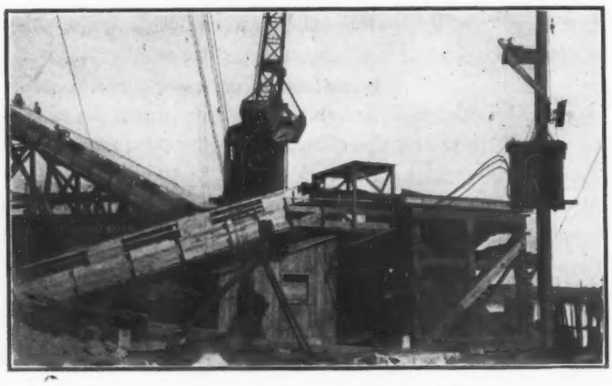


FIG. 1—LOCOMOTIVE CRANE AND CONVEYOR FROM TRACK HOPPER DISCHARGING INTO CRUSHER

house. The handling of the coal in this fashion is facilitated considerably by a clause in the company's coal contract which provides for separating mine-run coal at the mines into cars of either screenings or lump. This makes it possible, under ordinary circumstances, to store only screened lump coal and to use all screenings immediately. This practice will, of course, reduce chances of spontaneous combustion in stored coal.

The general arrangement of the tracks, conveyors, bunkers, crusher and hoppers is shown herewith. When coal is received in bottom-dump cars it is switched over a 41-ft. by 20-ft. (12.49-m. by 6.09-m.) track hopper. Two shakers in the bottom of the hopper driven through eccentrics and reduction gears from a 15-hp. squirrel-

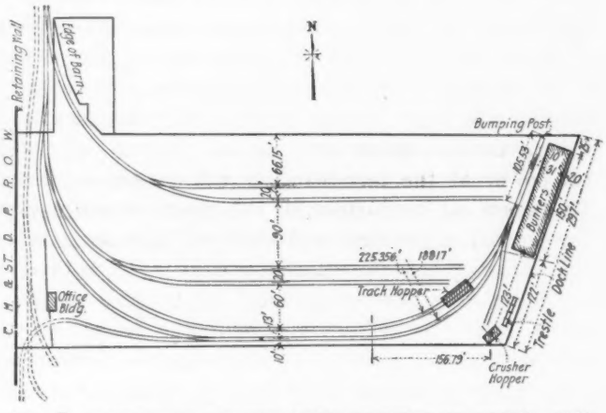


FIG. 2—LAYOUT OF TRACKS WITH RESPECT TO DOCKS, COAL HOPPERS AND BUNKERS

cage motor deliver the coal to a belt conveyor. These shakers have a travel of about 4 in. (10.2 cm.), which for faster operation may be increased to 10 in. (25.4 cm.) by shifting the eccentric settings. The reduction gears cut down the speed from 720 r.p.m. at the motor to twenty strokes per minute at the shakers. A 36-in. (91.44-cm.) belt which operates on 67-ft. (20.4-m.) centers rises from beneath the shakers at an angle of 19.5 deg. to the hopper over the coal crusher. This belt is driven by a 15-hp. motor and is now operating at 240 ft. (73.15 m.) per minute.

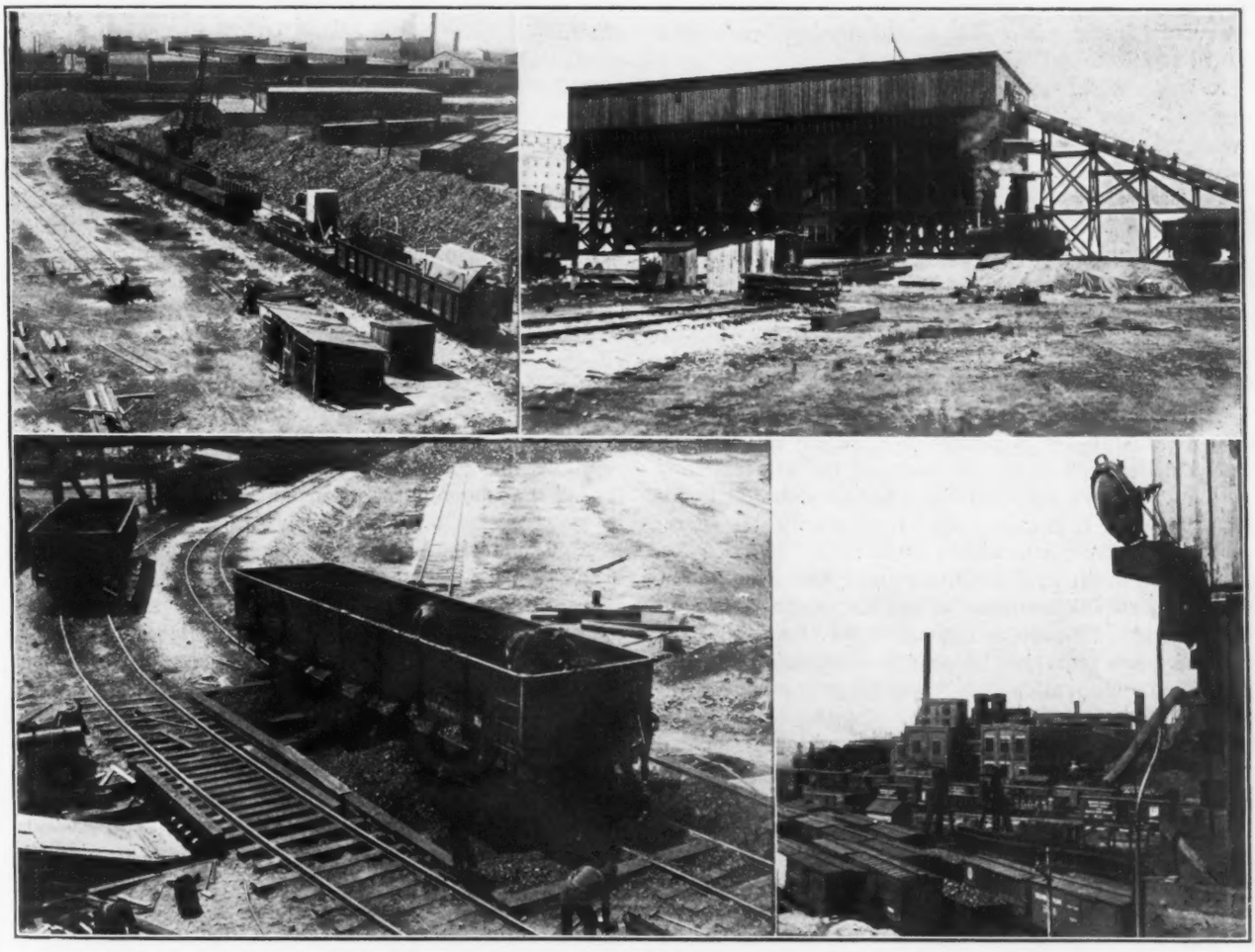
Coal which comes to the yard in cars which cannot be dumped is switched to the short siding near the crusher and is transferred to the crusher hopper by a locomotive crane. This hopper has been built with three sides sloping at 45 deg. and one side at 30 deg. in order that coal dropped into it from the belt conveyor will slide readily to the crusher. Coal dropped from the 1.5-yd. (1.15-cu. m.) bucket of the locomotive crane will slide slowly on the more gentle 30-deg. slope. This arrangement prevents unnecessary overloading of the crusher.

A grillage under the hopper separates the screenings and by-passes them around the crusher. This arrangement also tends to prevent clogging of the crusher, which is of the single roll, 36-in. by 36-in. (91.44-m. by 91.44-m.) type. It is driven through a belt at 60 r.p.m. by a 100-hp., 720-r.p.m. slip-ring motor. At this speed it will handle 250 tons (225 t.) of coal per hour, taking in Illinois or Ohio run-of-mine and reducing it to 15-in. (38.1-cm.) sizes. The slip-ring motor was selected for this service because of its better starting characteristics and also to permit reversing the crusher at times to

free the rolls. The single-roll type of crusher was chosen because at other plants operated by the company it has given satisfactory service with low maintenance costs even on hard grades of coal.

The fine coal leaving the crusher falls on a 30-in. by 150-ft. (76.2-cm. by 45.71-m.) rubber belt, which ascends to the water-side bunker at an angle of 22.5 deg. A 25-hp., 1800-r.p.m. type I motor drives this belt when it is loaded at 325 ft. (99.06 m.) per minute and delivers the coal to a 30-in. (76.2-cm.) flight conveyor running the full length of the bunker. The flight conveyor, which travels 100 ft. (30.48 m.) per minute, is connected through reduction gears to a 20-hp., 1200-r.p.m. motor. Utilizing the return side of this flight conveyor to trim the top of the coal piled in the bunker concrete. It measures 150 ft. (45.7 m.) long by 53.75 ft. (16.4 m.) high by 29 ft. (8.8 m.) wide. The substructure is all of mill construction, using mostly 10-in by 10-in. (25.4-cm. by 25.4-cm.) and 10-in. by 12-in (25.4-cm. by 30.48-cm.) yellow pine timbers each capped with a 0.5-in. (1.9-cm.) steel plate.

While the usual plan will be for this bunker to deliver coal to a river barge, spouts are provided for dumping into cars as an emergency method. When the barge "transfer" is used the water-side spouts are set and gates are opened by the boat crew from a gallery approximately at deck level. It takes about ninety minutes for the spouts to deliver 1500 tons (1350 t.) to the barge. This self-unloading barge is 200 ft. (60.9 m.) long, 34 ft. (10.4 m.) beam and 14 ft. (4.3 m.)



FIGS. 3 TO 6—LOCOMOTIVE CRANE UNLOADING OPEN-TOP CAR; 1500-TON COAL BUNKER ON WATERFRONT FED BY CONVEYOR; BOTTOM-DUMP CAR OVER SHAKER FROM WHICH CONVEYOR RISES TO CRUSHER, AND METHOD OF LIGHTING GROUNDS

has increased the capacity of the bin by about 150 tons (125 t.). Under ordinary conditions this conveyor and crusher equipment can fill the 1500-ton (1350-t.) bunker in eight hours.

From the water-side bunker coal is delivered by gravity through two sets of spouts into the barge on the river. As may be observed from the accompanying drawing, the floor of the bunker is at an angle of 45 deg. The floor is of double construction. Maple lumber 1 in. (2.54 cm.) thick was used on the inside to provide a smooth sliding surface and to facilitate repairs to the inside of the bunker. The whole structure stands on piles driven 65 ft. (19.8 m.) deep and capped with deep. It is equipped with a double hopper hold extending longitudinally. Beneath each hopper there are conveyors for carrying coal to two elevators, which in turn discharge into a 36-in. (91.4-cm.) rubber belt. This belt travels over a movable boom which is about 50 ft. (15.2 m.) long and can elevate coal about 26 ft. (7.9 m.). This belt unloads coal into the power-house bunkers at a rate of about 200 tons (180 t.) per hour. The 20-hp. motor which drives this belt and the 65-hp. barge-conveyor motor are supplied with direct-current energy through special water-side connections at the power houses.

At the outset the capacity and length of the bunker

were fixed at not less than 1500 tons (1350 t.) and 150 ft. (45.7 m.) respectively, because of the capacity and length of the barge which the company already owned. The location of the bunker along the water line was determined by the length of the barge, since it was necessary to distribute the coal fairly well in the hold and at the same time keep the barge prow inside the property line. The crusher was located as far south as possible and a 22.5-deg. line, which is about the steepest practical angle at which to elevate coal, was extended upward from crusher dump to determine the height of the top of the bunker. The height of the bottom of the bunker was fixed by the height of the barge as it stood in the river unloaded. With these limits of dimensions and capacity determined and keeping in mind the fact that approximately a 45-deg. angle is required to make coal slide freely the width of the bunker was determined at 29 ft. (8.8 m.).

It was not thought advisable to use an electric car for switching in the yard because were this done the trolleys would interfere with the free action of the locomotive cranes.

All of the motors except the crane units operate on 220-volt, three-phase, 60-cycle energy and were supplied by the General Electric Company. The locomotive cranes with 1.5-yd. (1.15-cu. m.) buckets were supplied by the Link Belt Company, and the stationary crane with the 1.5-yd. (1.15-cu. m.) bucket was secured from the Browning Company. These cranes are operated by 500-volt railway-type motors. The coal crusher was supplied by the Jeffries Manufacturing Company and the belts were purchased from the B. F. Goodrich Rubber Company. The design and construction of this coal-handling plant was carried out by the company's own engineers under the direction of John Anderson, chief engineer of power plants. The plant complete, exclusive of real estate, represents a capital expenditure of $75,000.

Reinstalling Old Cable Saves $200,000 at Chicago

Cables Which Have Undergone Twenty Years of Service Have Been Removed from Original Position and Successfully Installed and Operated in Other Duct Lines at Higher Voltage

PRICES of all materials and equipment are so high that it pays in every case to consider whether the maximum use is being obtained from every invested dollar and if not to reinstall the material and equipment where they will be utilized with the maximum benefit. Indications that it is practicable to remove cable from places where it has been in service and to reinstall it in new positions are given by the fact that the street department of the Commonwealth Edison Company, Chicago, is moving about 75 miles (120.7 km.) of cable from one location to another on its system. This innovation has been brought about principally by the increase of generating capacity in the Northwest Station making it possible to supply energy to all of the substations in its economic territory, whereas heretofore considerable energy had to be supplied to these substations from the Fisk Street and Quarry Street generating stations. About 70 per cent of the cable being moved is three-conductor, paper-insulated, lead-covered transmission cable which operates at 9000, 12,000 or 20,000 volts and at either 25 or 60 cycles. The remainder is four-conductor distribution-line cable for 4100-volt, three-phase, 60-cycle circuits.

The Commonwealth company's decision to reinstall this cable is evidence of the beginning of a change in general underground practice. Some engineers are still prejudiced against using, under any circumstances, cable that has been withdrawn from the conduits. Other engineers will not use cable under such conditions unless it is placed in service at a lower voltage than that at which it was originally used. All such ideas have been gradually eliminated at Chicago, largely by the persistent arguments of the men who were most closely in touch with the work, and by trials made during the past few years.

The contention of the men in the street department is that as long as the lead sheath remains intact and the insulation of the cable shows no signs of being damaged either by overheating or in any other manner, the cable is in condition to be utilized again after it has been drawn from the conduits. It is further contended that damage to the insulation by overheating or by moisture, or to the lead sheath by cracking, etc., can be easily detected by the men handling the cable if they are on the watch for defects. Paper damaged by overheating is easily detected when removing old joints and sealing the cable ends by the brittleness of the insulation. The company's men have been properly instructed regarding such watchfulness and it is felt that by giving the proper amount of care and attention to such minor details the troubles will be insignificant compared with the saving made by the reinstallation of the old cable. By carefully removing all cables, even from circuits which have been burned out, the portions which are not damaged can be utilized again at another location either on construction or on repair work. Moreover, the company's engineers have no prejudice against using the cable on even a higher voltage than the original if they think that the cable is adapted for service at this voltage.

About twenty years ago the company installed a number of No. 2/0 lines out of Harrison Street station for use on the 9000-volt, 25-cycle system, which was then just being developed. At that time No. 2/0 was the maximum size of cable used. This cable was taken out of service a few years ago when the Harrison Street plant was discontinued as a 9000-volt generating station. Until recently the cable has been in the ground properly sealed so as to protect it from damage by moisture. Now, however, the street department has pulled out between 1 mile (1.6 km.) and 2 miles (3.21 km.) of this cable and moved it to a new location several miles distant, where it is installed and placed in service on the 12,000 volts, 60-cycle system. Now the

cable has been in service about four or five months without giving trouble in operation.

One of the problems in connection with the transfer of this 75 miles (120.7 km.) of cable is to keep the wastage at a minimum. A system of record keeping has been worked out which is very helpful in solving this difficulty. This system permits lengths of cable from

FORM OU-16 SM-6-12-17

REEL NO. X456 FEET 488

	W.O.	LINE OR CIRCUIT NO.	SIZE CABLE	FEET CABLE	ASS'G'M'T NO.	DATE
REMOVED	6476-95C	Ckt.1 Gr	250	488	126	7-27-17
	LOCATION 36th St.-Al.W.Gage to Al.E.					
INSTALLED	7366-95C	T.L.2		486	420	
	LOCATION Paulina St.-Flournoy St. to Polk St.					
	LOCATION					
	LOCATION					
	LOCATION					

FIG. 1—TYPICAL CARD FROM RECORD USED TO REDUCE WASTAGE AND TO KEEP TRACK OF CABLE

various parts of the system to be selected and reinstalled at such new locations as will best utilize the lengths available. The system employed also makes it possible to keep the necessary hauling expense at a minimum, since the cable goes directly from its original location to its new location without extra unloading or transfer. A card file is used which lists, first, the cable available in storage; second, the cable available in the ground, and third, the cable not yet available but which will be released by future change-overs. Under each of these headings the pieces of cable are filed according to their lengths in order to make it easy to find a suitable piece for any location. Where a cable length is assigned to a new location the corresponding card is transferred to another file which is classified by lines or circuits. Thus a single card finally gives the full history of each cable length. Working sheets are made up from these cards for the convenience of the foremen and for the office men who follow the job in detail.

To reduce wastage further splices are being pulled into the ducts. It is the practice in such cases to select a long and a short piece of cable for splicing to the desired length. The longer piece is pulled into the duct until only enough remains outside the manhole to facili-

RECORD OF CABLE REMOVAL

LINE NO. 581-3-Bruce WO NO. 6476-95C

ASSGT NO.	REMOVAL ON	FROM	TO	REEL NO.	SIZE	EST. LENGTH	ACTUAL LENGTH	WASTE	INSTALLATION ON	FROM	TO	ASSGT NO.
126	36th St.	Al.W.Gage	Al.E.	2456	250	488	488	488	Paulina St.	Flournoy	Polk St.	420
127	Al.T.Morgan	35th Pl.	36th St.	60453	"	368	368	368	Crawford Av.	Al.W.Nolean	Al.E.	251
128	"	" "	35th St.	21278	"	358	358	358	" "	Wrightwood	MN S.	238
129	35th St.	Morgan St.	Al.T.	21365	"	185	188	188	Elston Av.	1st MN S.Robeon	2nd MN S.	352
130	"	" "	MN S.	21260	"	326	326	324	Congress St.	MN W.Hermitage	MN E.	410
131	"	2nd MN W.Morgan	2nd MN E.	21375	"	269	269	268	Crawford Av.	Wilmoore Av.	MN S.	266
132	"	Paulina Av.	MN S.	21167	"	359	361	362	" "	LeMoyne Av.	MN S.	366
133	"	" "	MN W.	46812	"	269	269	267	" "	Reildeer Av.	MN S.	240
134	"	Iron St.	1st MN E.	21363	"	331	334	334	" "	Belcont Av.	MN S.	238
135	"	" "	" " W	2076	"	439	439	438	Paulina St.	Polk St.	MN S.	421
136	"	1st MN W.Iron	2nd MN E.	2466	"	358	356	356	Crawford Av.	Altgeld St.	MN S.	239
137	"	2nd MN T.	3rd " "	21260	"	304	304	301	" "	Grand Av.	MN S.	267
138	"	Al.E.Ashland	MN S.	47555	"	360	360	361	" "	Berry Av.	MN W.	288
139	"	Ashland Av.	Al.E.	46168	"	184	184	182	" "	1st MN S.Altgeld	2nd MN S.	241
140	"	" "	Al.W.	21172	"	150	156	156	" "	Armitage Av.	MN S.	252

FIG. 2—RECORD USED FOR FOLLOWING JOB IN DETAIL

tate splicing. The splice is then made on the street level above the manhole and the splice and shorter piece are pulled in. This procedure, of course, reduces the tensile strain on the splice. About twelve such high-tension splices are now operating satisfactorily. Wire grips are used for pulling cables in and out, and it is the rule never to have more than one splice per run.

The splices which are used in the ducts differ from manhole splices in that the standard copper connectors are staggered to permit the use of a smaller lead sleeve, which in turn permits of easier pulling. For example, it is the practice on a duct splice to use a 2.75-in. by 27-in. (6.9-cm. by 68.61-cm.) lead sleeve in connection with a 250,000-circ. mil. three-conductor, 12,000-volt cable, while in manholes a 3.5-in. by 20-in. (8.8-cm. by 50.8-cm.) sleeve would be used on the same cable. Otherwise the joints are similar to the company's standard manhole splices.

The company's records to date, with the work about one-third completed, indicate that the wastage of cable is not more than 2 per cent above the ordinary wastage due to cutting off each length. As the work draws nearer to a finish it is expected that the wastage will increase to 3 per cent or 4 per cent since near the end of the job there will be fewer lengths to choose from.

The financial aspects of this job are particularly interesting and are especially important now. If the company's rules had prevented the removal of cable from one location to another it would have been necessary to have ordered new cable for all installations made this year. In all probability the old cable would have been pulled out and disposed of as junk. If this plan had been followed the increase in cost to the Commonwealth Edison Company would have been upward of $200,000.

This transfer of cable is being carried out for the Commonwealth Edison Company by D. W. Roper, superintendent of the street department, and N. E. Buck, superintendent of underground cable work.

Neon Tubes Employed for Lighting Purposes

In suggesting the employment of neon tubes for lighting purposes George Claude of Boulogne, France, in patent No. 1,231,494, proposes using mercury-vapor tubes in conjunction therewith in order to correct for the predominance of the neon red rays. The requisite correction can be obtained by introducing a few drops of mercury into a neon tube and then passing an alternating current through it to volatize the mercury till the neon radiations completely disappear. The radiations of this corrector tube are then added to the red radiations of an adjoining neon tube, giving a greatly improved resultant light. It is obvious, though, that in

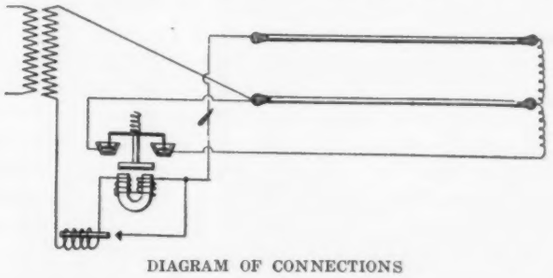


DIAGRAM OF CONNECTIONS

order to make the correction as perfect as possible the red light of the neon tube and the blue light of the neon and mercury tube must be suitably proportioned. It has been found that if the red tube and the blue corrector tube have the same diameter and the same current is passed through both, the blue tube should be about twice as long as the red one.

Government Policy in Cantonment Contracts

Labor Situation, the Basis of the Contracts, Sub-Contracts and the Method of Financing Were Problems for Which Solutions Had to Be Arranged

BY COL. I. W. LITTELL, QUARTERMASTER UNITED STATES ARMY IN CHARGE OF CANTONMENT CONSTRUCTION

SO MANY erroneous statements have been made and so much misinformation seems abroad with reference to cantonment construction that I assume the ELECTRICAL WORLD would be glad to publish the information which ought to clear up misapprehension.

In a work of such magnitude, aggregating all told sixteen camps, eighteen cantonments and thirty-two auxiliary remount depots, with an approximate expenditure of $150,000,000, and with the war condition facing us and the necessity for speed as the first essential, it can easily be seen that much disturbance would arise in the industrial world if the plans for letting of the contracts and financing them were not carefully laid and exactly carried out.

In the first place, there was the necessity to secure proper contractors, and this was done through the wise assistance of the Council of National Defense, which investigated and passed upon the ability and trustworthiness of the various contractors. After careful analysis sixteen of such contractors were selected and the sixteen National Army cantonment contracts were entered into on the "cost plus" basis. This form of contract was also carefully passed upon by the Council of National Defense, and the best advice in the country was obtained with reference to its requirements.

The second consideration that arose and which involved much time and thought and study to adjust satisfactorily was the labor situation. It was realized that if men were to be attracted from one camp to another by the paying of higher wages, the government would be bidding against itself and to its detriment; accordingly a policy was adopted of paying the regular union rate of wages in force on June 1, 1917, in the locality in which the camp was situated.

The third question had to do with the question of subletting contracts. The main contractor was chosen with the idea that he was big enough to do the entire work, but if for reasons of speed as well as economy it was found that specialized constructions—such as electrical wiring, water and sewer systems, heating, plumbing and so forth—should be sublet, such items were sublet, the sub-contractor on such contracts to be paid a percentage established by the contract and the main contractor to be paid 5 per cent of the sub-contractor's cost.

The fourth general question requiring considerable thought and study had to do with the financing of the work. The plan finally adopted and which practically results in the United States financing these huge projects was as follows:

1. The contractor was to be paid for all material received at the camp just as soon as the United States took title thereto, and to accomplish this proper forces at each camp and cantonment were organized so that cars would be unloaded immediately, and as soon as they were unloaded and the material inspected the United States took title.

2. For purchases made f.o.b. manufactory or mill, upon proper information to the constructing quartermaster that the material had been delivered to a common carrier, and to protect the government in taking discounts, the contractor was obliged on receipt of such information to discount his bills. As soon thereafter as he presented the shipper's or vender's receipt for his expenditure he was promptly reimbursed therefor by the government.

3. The contractor is paid weekly to cover his payroll as soon as he presents to the quartermaster a properly receipted and certified roll showing that he has made the expenditures in question.

4. On the ninth of each month the contractor receives the portion of his fee which has accrued to him under the contract as soon as he presents a proper statement showing total disbursements, and in addition he receives reimbursements for such other expenditures as he has made during the prior month and on which there were no discounts.

From the above I think you will see that, so far as it was humanly possible, and keeping ever in mind the speed required in this construction and the further fact that if quick preparedness shortened the war by one day most if not all of the cantonment cost would be equalized, all interests, both of the government and of the people, have been fully and amply protected.

Contractors Ready to Serve the Government

Are Given No Opportunity to Bid on Cantonment Construction Because of Instructions of Quartermaster's Department that "Sub-Contracts Are Not Looked Upon with Favor"

BY L. K. COMSTOCK

THE President's address to his fellow countrymen on April 16, 1917, called to the colors an army of civilians anxious patriotically to support the government behind the lines in its effort to prepare for the great crisis. The President said: "The eyes of the country will be especially upon you. This is your opportunity for signal service, efficient and disinterested. The country expects you, as it expects all others, to forego unusual profits, to organize and expedite shipments of supplies of every kind . . . with an eye to the service you are rendering and in the spirit of those who enlist in the ranks for their people, not for themselves."

On May 7 the Institute of Electrical Contractors passed a resolution offering to co-operate with the government on any terms the government might elect. The resolution also provided for a committee of four to proceed to Washington at once to communicate this action to those governmental departments and officials interested in the kind of service offered. When the committee reached Washington it soon discovered that all roads led either to the Council of National Defense or to the Shipping Board. A little later it recognized the truth of the old saying that all governments produce "either an ordered universe or else a welter of confusion."

The institute committee found its way to the Munitions Board, presided over then by Frank A. Scott. When Mr. Scott learned of the committee's mission he praised the industry and the institute for its loyalty and patriotism and eagerly accepted the co-operation offered, and turned the institute committee over to W. A. Starrett, chairman of the sub-committee on emergency construction and engineering. This sub-committee was occupied chiefly at that time with the work pertaining to the selection of camp sites for the National Army and the planning and building of the cantonments, in co-operation with the Quartermaster's Department.

The institute committee was told that it had reached Washington at exactly the right time to be of great assistance in this work, and if the institute could show that it was representative of the industry throughout the country, the Munitions Board would be glad to give it representation in the board as an electrical sub-committee. The institute committee could not and did not so qualify, but in the belief that the government needed the aid such representation in the Munitions Board could give it undertook to bring to Washington a committee which could truly qualify as being representative of the industry at large.

CONVENTION FORMS COMMITTEE

There being no existing mechanism for creating such a committee in an emergency, a convention was called to meet at French Lick Springs, Ind. To this convention were invited those contractors most accustomed to executing large contracts at points more or less removed from their home offices.

This convention appointed a committee of seven to proceed forthwith to Washington to resume the work where the institute committee had left off. This committee of seven included the former committee of four.

The chairman of the Munitions Board was then advised that a committee of seven had been appointed to advise with the Council of National Defense; that it had been appointed by a convention called for that purpose, by a convention made up of representatives from thirteen of the largest cities in the country.

Representation was immediately provided for this committee in the Munitions Board. But simultaneously the Council of National Defense, consisting of six Cabinet officers, had resolved that no more sub-committees should be established; therefore the action of the Munitions Board was killed by the simultaneous action of the council.

This situation, however, did not mean that we had less service to offer than before, nor that we offered it less patriotically. It did mean, however, that we were less frequently called upon and we had no formal standing. This committee of seven believes that the Munitions Board and its sub-committee on emergency construction were sincerely desirous of the services the

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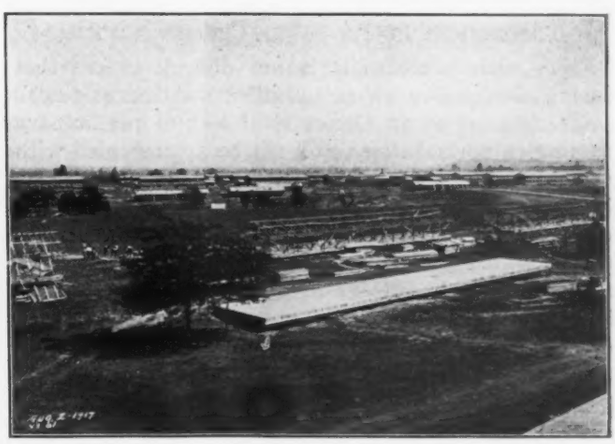


contractors' committee had to offer; but the Quartermaster's Department, with which the Council of National Defense was co-operating, could see no value in these services.

Electrical Contractors Shut Out

The Quartermaster's Department did not care for advice from the committee of seven, and in the "Instructions to Constructing Quartermasters on Cantonment Work" occurs the following clause: "Sub-contracts are not looked upon with favor." This clause was interpreted, all but universally, by constructing quartermasters and general contractors to mean that such work as is usually sub-contracted could not be sub-contracted under the rulings of the Quartermaster's Department. The rule is equivocal, but its effect has been to shut out the electrical contractor in most cases. Why has the electrical contractor been shut out? Surely not on account of his demand for exorbitant profits, because he never got to the point of discussing costs, to say nothing of profits. It has been stated that the government wanted unit responsibility. It has been stated also that the government desired to save a sub-contractor's profit.

The claim is made that unit responsibility is gained only by letting contracts to general contractors who can perform all or most of the branches of work.

This claim is not valid, because responsibility is passed on to the sub-contractor precisely in the same manner that one or more employees of the general contractor would assume their proportion of the unit responsibility.

It is a noteworthy fact that most electrical installations of importance in normal times have been executed by electrical contractors working directly for owners, including the United States government, or indirectly through general contractors, a fact which argues strongly for the electrical contractor and in support of his claim for efficiency, economy and speed.

Whence it follows that the general contractor normally unaccustomed to such work has not built up, and does not maintain, electrical organizations. He is convinced that it does not pay to do so because he does not have continuously enough of this class of work to justify the expense. These considerations have brought about the all but universal custom among general contractors of subletting electrical and other mechanical work. But the government's recent interpretation of the term "general contractor" seems to be such as to force the general contractor into the unaccustomed and embarrassing situation of executing work ordinarily done by sub-contractors.

Theoretical Profit Saved, Cost Increased

From what precedes it is not difficult to see that placing electrical work in unskilled and inexperienced hands, because of an almost total lack of preliminary training in normal times, will not be accompanied with economies and efficiency, particularly when the time element is so important. A theoretical profit only is saved, which is much more than counterbalanced by a cost increased by lack of training and experience, by lack of precise knowledge of labor and market conditions.

By ignoring the expert electrical contractor, the government is not only failing to reap an advantage from a great industry willing to perform patriotic services, but is lending its influence to the destruction of that industry which under normal conditions has demonstrated as much right to live under the just and benign influence of the government as those industries now enjoying governmental patronage.

The committee of seven does not think it failed in any essential particular, and yet it failed to convince the Quartermaster's Department that electrical work should be done by those most accustomed to it and therefore most expert in it. The committee failed to convince the Quartermaster's Department that mastery of technique is efficiency, a truth requiring only statement to gain instant acceptance among most people.

Notwithstanding the experience that electrical contractors have had up to this time with the Quartermaster's Department, they still hold themselves in readiness to perform any services which they may be called upon to perform. There is no thought on the part of the various organizations in the electrical contracting industry of doing otherwise than performing patriotically every service it is within their power to perform which may be required by the government.

PRODUCING ELECTRICITY DIRECT FROM COAL GAS

Electricity Is Produced Directly from the Oxidation of a Fuel in a Battery Containing a Fused Electrolyte

S. Albert Reed of New York City, in patent No. 1,225,175, discloses an electrolytic cell which amounts substantially to the production of electricity direct from coal gas. The principle of the method is to dissolve in an electrolyte of fused borax the oxide of a metal such as manganese, which forms easily two or more oxides of different degrees of oxidation and readily passing from a lower to a higher degree of oxidation when in contact with air and from a higher to a lower when in contact with a reducing agent, such as fuel gas. When the solutions of a higher and a lower oxide are brought into liquid contact at any point a difference of electrical potential results, and if an appropriate electrode is immersed in each of the solutions a current of electricity will pass in a conductor joining them, so long as the difference of oxidation respectively in the two solutions is maintained. The current obtained when the electrodes are of platinum and the metallic oxide in solution is an oxide of manganese is approximately 1 volt, and current is furnished from 15 amp. per square foot of active surface and upward.

In a heated chamber is placed a shallow dish of refractory earthenware, within which there is contained a smaller shallow dish of similar material forming a reduction chamber. A tube for supplying fuel gas is led into the inner chamber and vent holes are also provided for the products of combustion. The electrodes are placed in the inner and outer portions of the borax electrolyte containing the separate forms of manganese oxide. So long as fuel gas is supplied to the tube the normal differentiation of the two oxides is maintained and a current flows continuously through the circuit. The oxygen which oxidizes the fuel is actually supplied electrolytically from the air taken up at the outer extended surface, such air being present inside the heated chamber.

Street-Lighting Units in the Smaller Cities

A Discussion of the Characteristics of Gas-Filled Incandescent Lamps and Magnetite-Arc Lamps, and of Available Accessories, Together with Some Operating Cost Data

BY JAMES R. CRAVATH

In this article, the second in the series on street lighting for small cities and towns, the characteristics of the available lighting units for use in this connection are discussed in great detail. Particular attention is given to lamp rating, and to the relative value of different accessories under certain conditions of spacing and type of street. The relation between first cost and operating cost of gas-filled incandescent lamps and magnetite arcs is emphasized. In addition to the article and that in last week's issue on general principles and objects of street lighting, the series will include four other articles which will take up in order posts, residence streets, business streets, and finally municipal relations.

AT PRESENT the only two illuminants in the electrical field to be considered for street lighting in small cities are the gas-filled tungsten incandescent lamp and the luminous or magnetite-arc lamp. The inclosed carbon arc lamp is now virtually a matter of history, and the flame carbon arc likewise. The latter, although of very high efficiency when first trimmed, does not maintain its efficiency throughout the life of the carbons because of the thick deposits on the globe.

Electric lamps are now rated according to their light output in lumens. The lumen is a shorter, and in many ways a more convenient, term than the mean spherical candlepower. A lumen is equal to 12.57 times a mean spherical candlepower. Thus a lamp of 100 mean spherical candlepower gives out 1257 lumens. One lumen is the quantity of light which will illuminate a surface 1 ft. (30.48 cm.) square to an illumination or flux density of one foot-candle.

Series incandescent lamps for street-lighting purposes are still given a nominal candlepower rating by the manufacturers because many street-lighting contracts are in existence which call for a certain candlepower of lamp. The manufacturers arrive at this nominal candlepower rating by dividing the lumens rating by 10. The mean spherical candlepower is found by dividing the lumens rating by 12.57. In making new street-lighting contracts it is important that central station men understand clearly this situation, so that specifications may be drawn that are not ambiguous.

In making contracts which call for incandescent lamps the established policy of American lamp manufacturers regarding changes in efficiency should be kept in mind. When changes are made in the efficiencies of series lamps used for street-lighting service the lumens outputs are not changed for the various sizes of lamps, but the wattage is reduced. A contract calling for lamps of a certain watt rating on a series circuit, therefore, is likely to make trouble for the central-station company whenever lamp efficiencies are increased. On the other hand, multiple lamps are kept at the same wattage by the manufacturers, and the output in lumens increased as efficiencies change. Therefore, contracts for multiple lamps should not be on a candlepower or luminous-output basis.

Table I gives the common standard sizes of gas-filled tungsten incandescent lamps for series circuits. The lumens output of each lamp is, of course, that of the bare lamp, without any accessory for controlling or diffusing the light. There are practically no cases in street-lighting practice where the use of some kind of an accessory is not advisable. It is always necessary, therefore, to go several steps further in judging the relative merits of an illuminant as compared with some other illuminant than merely to look at the output in lumens of the bare lamp. The amount of light absorbed by whatever reflector, globe, refractor, or other accessory, is used must first be deducted from the output of the bare lamp. Both of these steps, however, are but preliminary, because the final test is the distribution of illumination on the street and objects thereon.

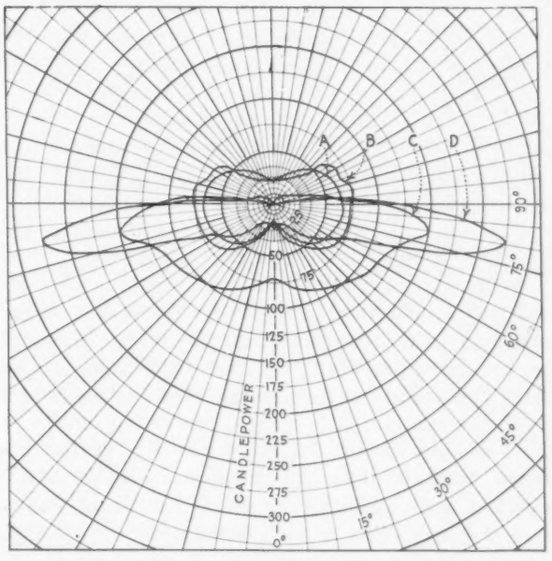


FIG. 1—LIGHT DISTRIBUTION FROM A SERIES 1000-LUMEN GAS-FILLED TUNGSTEN LAMP

A. Diffusing globe (Carrara) upright post-head type. B. Diffusing globe (Alba) upright post-head type. C. Radial wave reflector. D. Bowl refractor (plain pendant).

Fig. 1 gives the approximate distribution of candlepower about a 1000-lumen gas-filled tungsten lamp with four different accessories in common use, two being of recent design. The light distribution of the bare lamp, being of no practical interest, is not given. For all locations where maximum economy of light is desired the bare lamp involves the wasting of too much light upward, while for ornamental lighting, where some upward light may be desirable for lighting buildings, it is not only not ornamental but is too crude and glaring.

In Fig. 1, curve A is the light distribution with a common form of white diffusing glass (Carrara) inclosing globe on a common one-lamp post-head type of standard now much in vogue. With such a globe the

diffusion and ornamental effects are good. For the particular globe shown the total absorption was about 31 per cent.

Curve B is for a similar-shaped globe (Alba) which is not quite so absorbent. The total absorption with this globe is about 25 per cent.

Curve C is the light distribution with a radial wave

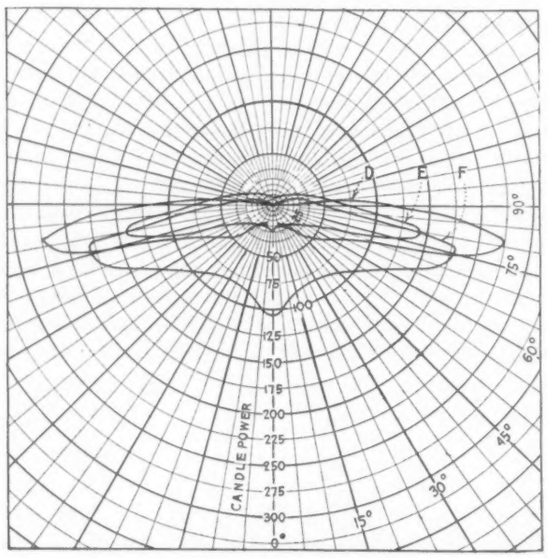


FIG. 2—LIGHT DISTRIBUTION WITH REFRACTORS ABOUT A 1000-LUMEN SERIES GAS-FILLED TUNGSTEN LAMP

D. Plain bowl refractor (pendant). E. Band refractor above horizontal, diffusing globe below (ornamental post-head fixture). F. Refractor and stippled inclosing globe (pendent fixture).

or flat-fluted reflector. This reflector is of value in catching the upward light and directing it slightly below the horizontal, so that the maximum is about 80 deg. from the vertical. The light absorption is from 12 per cent to 21 per cent, depending on the size of the reflector and the relative position of the lamp filament. For locations where the radial wave reflector is suited, a high candlepower at 80 deg. from the vertical is more important than the matter of total absorption. This type of reflector, however, absorbs the least of any of the common street-lighting accessories. On the other hand, with it the lamp filament is fully visible, so that the glare is practically the same as with a bare lamp as far as the light direct from the lamp is concerned. Sweet's experiments on glare indicate that attempts to diffuse the light from the filament are of little avail in reducing the measurable blinding effect, although the glare from a large globe is less annoying than that from a bare filament of the same candlepower, even though the blinding effect may be the same.

Curve D is typical for a refractor globe so placed with reference to the lamp filament that the maximum candlepower is given at 80 deg. above the vertical, which is the usual adjustment for refractors. By slightly lowering the refractor with reference to the lamp filament the maximum candlepower can be obtained at lower angles, even as low as 65 deg. from the vertical. The absorption of light is from 31 per cent to 39 per cent for a plain bowl-type refractor.

The prominent fact about the candlepower distribution with a refractor is the high candlepower obtainable at angles slightly below the horizontal for the purpose of increasing the illumination midway between lamps spaced a considerable distance apart. As a general rule, a plain refractor equipment gives a maximum candlepower equal to somewhat more than one-fifth the lumen output of the lamp.

UNITS DESIGNED TO SHED MORE LIGHT NEAR LAMP

The action of the refractor is both to diffuse and redirect the light. Some felt that the earlier forms of refractors accomplished the concentration of light in the 80-deg. zone too well and took too much light away from points near the lamp. Later designs, however, have corrected this by allowing a larger percentage of light to fall near the lamp, so as to produce a more brightly lighted street surface for silhouette effect and to mark street intersections.

Until recently refractors have been largely used on residence and other streets where lamps must be placed a considerable distance apart. Now they are being used in fixtures adapted to more ornamental classes of work with shorter spacings. In Fig. 2 are shown light-distribution curves with two recent types of this class, and, for comparison, curve D of Fig. 1 is plotted also on Fig. 2. Curve E is for an ornamental post-top fixture with upright lamp. A band type of refractor extends from a plane horizontal with the lamp filament upward to the top of the fixture. Extending down from the point where the refractor leaves off is a (Carrara) diffusing globe. The function of the refractor is to redirect the upward light, making the maximum candlepower about 80 deg. from the vertical. The object of the lower diffusing globe is to illuminate the street near the lamp. The entire arrangement absorbs considerably more light than a diffusing globe alone would

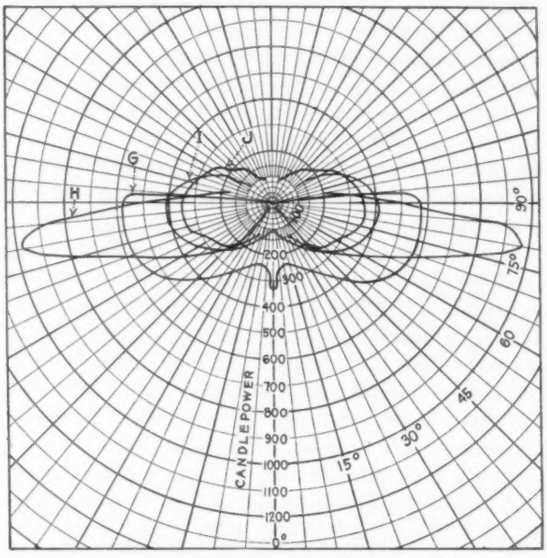


FIG. 3—LIGHT DISTRIBUTION WITH 4-AMP., 310-WATT MAGNETITE LUMINOUS-ARC LAMPS; LONG-LIFE, LOW-EFFICIENCY ELECTRODE

G. Clear globe, small internal reflector. H. Clear globe, band refractor. I. Opal globe. J. Light Alba globe, ornamental post-head-type lamp.

do, but for certain locations where lamps are spaced long distances apart, and where an ornamental post-head is required, its use is justified. It is preferable to any attempt to put a diffusing globe outside of a refractor unless the diffusing globe be of a character which accomplishes but little diffusion, such as the stipple globe.

Curve F, Fig. 2, shows the light distribution about a new type of fixture which has a band type of refractor, shaped something like a dome or bowl reflector, immediately over the lamp. Outside of this refractor is a stippled glass globe of very slight diffusing quality. That is, the glass is slightly irregular in its surface, so as to produce a slight breaking up of parallel rays,

TABLE I—SERIES GAS-FILLED TUNGSTEN LAMP SIZES AND EFFICIENCIES

Amp.	Nominal Rated Cp.	Total Lumens	Average Volts	Average Watts	Watts per Spherical Cp.	Lumens per Watt
5.5	60	600	8.5	46.8	0.98	12.82
5.5	80	800	10.8	59.5	0.93	13.51
5.5	100	1,000	13.0	71.5	0.90	13.96
5.5	250	2,500	29.7	163.0	0.82	15.32
5.5	400	4,000	47.4	260.0	0.82	15.32
6.6	60	600	7.1	46.8	0.99	12.69
6.6	80	800	9.1	60.0	0.94	13.37
6.6	100	1,000	10.9	72.0	0.90	13.96
6.6	250	2,500	23.5	155.0	0.78	16.11
6.6	400	4,000	37.1	244.0	0.77	16.32
6.6	600	6,000	55.7	368.0	0.77	16.32
7.5	60	600	6.4	48.0	1.00	12.57
7.5	80	800	8.0	60.0	0.94	13.37
7.5	100	1,000	9.6	72.0	0.90	13.96
7.5	250	2,500	19.6	147.0	0.74	16.98
7.5	400	4,000	30.5	228.0	0.72	17.45
7.5	600	6,000	45.8	344.0	0.72	17.45
*15	400	4,000	15.3	230.0	0.72	17.45
*20	600	6,000	15.5	310.0	0.65	19.33
*20	1000	10,000	25.9	520.0	0.65	19.33

*For use on alternating-current circuits with compensator at lamp.

but not enough to change greatly their directions. The result, as seen, is a light distribution midway between that obtained by the radial wave reflector and the bowl refractor. This is well suited to some classes of work. The total light absorption of the accessory is only about 25 per cent. The fixture is of the pendent type, however, which necessarily involves less obstruction of the light than an upright fixture which has the post top below and a ventilator cap above to obstruct the light.

All of the types of light distribution illustrated in Figs. 1 and 2 have their legitimate places in street lighting. Whatever is said here as to the proper places for the different types of distribution will apply to both the magnetite-arc lamp and the incandescent lamp, provided always, of course, that a unit as large as an arc can be maintained.

In the lighting of business streets the common demand is for an ornamental effect, obtainable only with lamps at intervals of less than 150 ft (45.72 m.). On such streets the uniformity obtainable with diffusing globes is sufficient, so that there is no unpleasant contrast between maximum and minimum illumination on the street surface. The ornamental effect of the diffusing globe is desirable, and the fact that it throws considerable light above the horizontal upon buildings is by no means detrimental.

For residence streets, on the other hand, where maximum economy in construction and operation is demanded, long intervals between lamps are necessary, and distributions like those obtained with the refractor and radial wave reflector are desirable. The street-surface brightness midway between lamps, as compared with points under lamps, will at best present considerably more contrast than is desirable, so that the increasing of the illumination midway between lamps can well be done at the expense of that under the lamp. Incidentally, it may be said that the enormous contrasts produced by a light distribution which throws too much illumination immediately under the lamp are bad in themselves, in spite of the silhouette background which they offer, because the eye adapts itself to the brightly lighted portion of the street surface, and the portions between appear much darker by contrast than if the differences in brightness were not so great. There are many streets occupying a position between the two classes already outlined where some ornamental effect is desirable, or where the lamps can be spaced frequently enough so that it is not necessary to make extreme sacrifices to deliver as much light midway between lamps as possible. For such streets, intermediate distribution, such as shown on curves *e* and *f* of Fig. 2, would represent good practice.

Table II shows the sizes and efficiencies and luminous output of the common types of 110-volt multiple tungsten lamps which are sometimes used for street lighting in business streets, and should, therefore, be compared with series lamps for which Table I is given. By means of accessory appliances these multiple lamps can be made to give nearly the same distributions as the series lamps, although the greater concentration of the filament on the series lamps makes light control somewhat more accurate.

It will be noted that the series lamps are always more efficient than the multiple lamps, as they have shorter, thicker filaments, adapted to higher efficiency in gas-filled lamps. The question of series versus multiple lamps for a given piece of street lighting is partly one of electrical distribution and partly one of efficiency.

MAGNETITE ARC ACCESSORY CHARACTERISTICS

Table III gives data on the magnetite or luminous arc lamp in various sizes, with various globe equipment. It will be seen that these lamps are made for use with two grades of electrodes, one known as the long-life, or standard, and the other as high-efficiency. There is a great gain by the use of the high-efficiency electrode,

TABLE II—MULTIPLE GAS-FILLED TUNGSTEN LAMP SIZES AND EFFICIENCIES, 110-125 VOLT

Watts	Watts per Spherical Cp.	Lumens per Watt	Total Lumens
75	1.09	11.53	865
100	1.00	12.57	1,260
150	0.92	13.66	2,050
200	0.86	14.61	2,920
300	0.78	16.11	4,850
400	0.82	15.32	6,150
500	0.78	16.11	8,050
750	0.74	16.98	12,800
1,000	0.70	17.95	18,000

as can be seen from these tables, a gain which much more than offsets the additional cost of trimming labor and electrodes. Frequent trimming is conducive to higher efficiency, in that it makes possible the cleaning of the globe at more frequent intervals.

Fig. 3 shows the light distribution obtainable with common accessory equipment of luminous arcs. All of

these curves are based on a 4-amp. lamp with long-life electrodes.

Curve G is for an ordinary pendent type of lamp, with clear globe, and a small white-enameled reflector immediately above the arc.

Curve H, Fig. 3, shows the same type of lamp with a band refractor instead of a reflector for catching the upward light. The refractor intercepts only the light which is emitted above the horizontal.

Curve I, Fig. 3, is for a similar lamp equipped with an opal globe of the pendent type.

Curve J. Fig. 3, is for an ornamental post-head type of lamp with an Alba diffusing globe.

COMPARISON OF FIRST AND OPERATING COSTS OF INCANDESCENT LAMPS AND MAGNETITE ARCS

Comparing the light output of the magnetite-arc and series incandescent lamp, we see when the losses in the accessories are taken into account that the magnetite arc is somewhat more efficient in large units. However, they are sufficiently close together in performance so

TABLE III—SERIES LUMINOUS OR MAGNETITE ARC LAMP SIZES AND EFFICIENCIES WITH VARIOUS EQUIPMENT

	Amperes	Magnetite Electrode Life, Hours	Globe and Reflector	Terminal		Lumens	Lumens per Watt
				Volts	Watts		
A—Plain Pendent Types	4	250	Clear globe and small internal reflector	68	272	3142	11.5
	4	350	Clear globe and small internal reflector	77.5	310	3320	10.7
	4	350	Carrara globe, small internal reflector	77.5	310	3190	10.3
	4	350	Prismatic refractor, clear globe	77.5	310	3260	10.5
	4	150	Carrara globe, small internal reflector	77.5	310	5010	16.2
	4	150	Clear globe, refractor	77.5	310	5030	16.2
	4	150	Clear globe, small internal reflector	77.5	310	5320	17.2
	5	225	Carrara globe, small internal reflector	77.5	388	5090	13.1
	5	225	Clear globe, refractor	77.5	388	5170	13.3
	5	225	Clear globe, small internal reflector	77.5	388	5350	13.8
	5	120	Carrara globe, small internal reflector	77.5	388	7260	18.7
	5	120	Clear globe, refractor	77.5	388	7260	18.7
	5	120	Clear globe, small internal reflector	77.5	388	7650	19.7
	6.6	125	Carrara globe, small internal reflector	77.5	510	8800	17.3
	6.6	125	Clear globe, refractor	77.5	510	8960	17.6
	6.6	125	Clear globe, small internal reflector	77.5	510	9300	18.3
B—Ornamental Post-Head Types	4	350	Alba globe	82.5	330	3220	9.75
	4	180	Alba globe	82.5	330	4970	15.1
	5	237	Alba globe	80.5	403	5020	12.5
	5	137	Medium-density diffusing globe	80.5	403	7640	19.0
	6.6	112	Medium-density diffusing globe	80.5	532	9120	17.1

that in nearly every case where units large enough to employ arcs are required the entire cost of service must be figured up for the two types.

For incandescent lamps it is customary to figure upon three renewals per year when lamps are operated upon a 4000-hour, all-night, every-night schedule. Lamps are made to operate at an efficiency which will give an average life of about 1350 hours. Current prices for lamps can be obtained from the manufacturer, and it is then a simple matter to figure the lamp renewal cost per hour of operation. This cost is a very large item in the total cost of street-lighting service with this kind of lamp. To the cost of lamp renewals must be added cost of cleaning and repairs. Cleaning should be done once a month, although frequently on incandescent systems it is done less often. Reliable figures, based on extensive experience with cleaning in an incandescent-lamp system are difficult to obtain, but for small cities a cost of 5 cents to 10 cents per cleaning per lamp will probably suffice. The cost of inspection for burned-out lamps and the cost of renewal will depend much on local conditions and the thoroughness and frequency of the inspection. In many small cities this cost is very small and the amount of attention given to inspection is proportionately small, as city night watchmen reports are largely relied upon to locate burned-out lamps. It would be unsafe to name a figure on this without knowing local conditions. As to renewals of glassware, such as globes and refractors, and repairs to lamp fixtures, it would seem from experience in larger cities that 50 cents per lamp per year would suffice, without much regard to the type of globe, because while refractor globes are much more expensive than other types they are also much heavier and less liable to breakage.

In figuring the cost of delivering energy to the lamp it must be remembered that for the sake of getting high lamp efficiency with incandescent lamps a constant current circuit of 6.6 amp. rather than less is advisable, while with magnetite arcs 4-amp. circuits may have to be adopted to get a small enough source of light. Now since nearly all systems of series circuits are of No. 6 wire, for mechanical reasons the same size of wire would be used whichever lamp is adopted and the line loss would be greater at 6.6 amp. than at 4 amp.

At the power station there is a difference in favor of the incandescent lamp because it is operated on alternating current direct from constant-current transformers. Unless such transformers are very much underloaded the efficiency can be kept between 85 per cent and 95 per cent. The power factor will run from 90 per cent to 95 per cent. To supply magnetite arcs, however, a rectifier must be used in addition, which, if we assume transformer and rectifier nearly loaded, will cause approximately an additional 5 per cent loss and a decrease in the power factor to about 65 per cent at full load and 50 per cent at three-quarters load. The generating apparatus investment caused by this low power factor is chargeable to the magnetite-arc system.

The cost of trimming and maintenance of magnetite-arc lamps, including everything necessary for the maintenance of the lamp and its glassware, but no line maintenance, is about $3.25 in one medium-sized city where accurate records have been kept. In small cities in the past this cost has probably run from $5 to $6.

The investment in station apparatus and lamps is easily obtained from electrical manufacturers. During the past few years magnetite lamps with the necessary rectifiers and transformers, if the lamps are of the plain center suspension type, have cost around $50 per lamp, of which roughly half is for the lamp and half for the station apparatus.

An item of operating cost with the magnetite system, which, although a station cost, is usually included in the lamp-year estimate, is that of rectifier tubes. In small systems this runs from $3 to $4 per lamp-year.

The cost of the lamp-supporting pole and the cost of the line, being usually very large proportions of the total investment, impose fixed charges which are a large item of the total yearly costs.

LABORATORY VERSUS ACTUAL CONDITIONS

Because of the great differences in maintenance conditions no rule can be laid down for figuring any differences between laboratory and street performances, but

it would seldom be safe to count on less than 25 per cent loss due to globe dirt and bulb blackening, and in many cases this will be 50 per cent. While blackening may amount to 20 per cent toward the end of the life of a lamp, the average loss from this would not be over 10 per cent. Bulb blackening is of course entirely beyond the control of the operating man. Light loss from this cause, however, can be lessened by renewing lamps when they become blackened rather than by waiting for them to burn out. Globe and reflector cleanliness is entirely within the control of the operating man.

In the case of the luminous-arc lamp loss of efficiency in service as compared to laboratory conditions is almost altogether a matter of maintenance. This type of lamp makes a very excellent showing when well maintained and a very poor showing when not so maintained. The luminous arc is unsteady and subject to very sudden variations in light caused by shifting of the arc. Feeding also causes variations. This, of course, detracts from the value of the laboratory rating, but is to some extent offset by the blackening of the tungsten lamp when the two lamps come up for comparison.

Limiting Alternator Short-Circuit Currents

Resistance Added to Field Circuit Causes Rapid Decline of Transient Short-Circuit Current, While Self-Inductance Reduces the Initial Value Thereof

BY RALPH BOWN
Department of Physics, Cornell University

ALONG with the development of modern alternating-current generating units of large capacity has come the problem of protecting them against the destructive effects of accidental short circuits. The enormous forces on the machine and its equipment resulting from short circuit occur with the first transient values of the short-circuit current and so cannot be obviated by any circuit-opening device so far in practical existence. Recourse has generally been had to reactance coils, placed in series with the generator, so as to limit the maximum value of the current which could flow. Introducing extra reactance or resistance in the power circuits has some disadvantages, however, such, for instance, as spoiling the regulation.

Since it has been suggested that placing reactance or resistance, or both, in the field circuit of the alternator might have the desired effect on the transient current and still leave the normal operation unchanged, the author of this paper will discuss the theory of such an arrangement in a more or less qualitative way. First its possibilities will be analyzed. Then some preliminary data which have been obtained by actual experiment will be presented in connection with a few general remarks which may be of aid to any one desiring to make more extensive and conclusive tests than could be carried out by the author with the facilities at his command.

The short-circuiting of a polyphase alternator brings into play a complicated set of actions and reactions which are so interdependent and interrelated that anything like a simple explanation is difficult. However, the results may be considered as due to several causes acting together. These causes may be treated separately and their resultant effects determined more or less closely by the superposition of the separate effects. On this basis a qualitative theory is built up which seems to explain all the facts.

When the terminals of the alternator are brought into contact, forming a short circuit, the armature current is established as in any polyphase circuit containing resistance and self-induction. The transient current is of much the same nature as that which flows when an induction motor is connected to the line and the rotating field built up. In the present case the rotating field is the armature reaction, which is fixed in space, but rotates synchronously backward with respect to the armature. The electric and magnetic conditions are somewhat the same as those which would exist if the machine were running idle with no excitation and suddenly had impressed on its terminals full synchronous voltage from an outside source. That the likeness exists only for a very short time, however, will soon become evident.

Since the armature current is at first limited largely by the true armature reactance, this current will lag

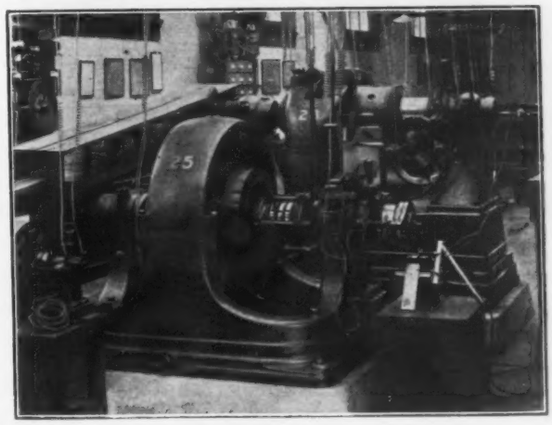


FIG. 1—TEST ALTERNATOR EQUIPPED WITH AUTOMATIC DEVICE FOR CLOSING CIRCUIT AT SAME POINT IN CYCLE EACH TIME

nearly 90 deg., and thus its magnetomotive force will act in opposition to that of the field. That is, the armature reaction will have the same space relation to the field poles as it has when the machine is running normally with a low lagging power factor, though it will have a greater intensity. The effect of this large bucking magnetomotive force is immediately to cause a reduction in the main field flux. According to Lenz's law a reduction in the flux induces an electromotive force in the field winding tending to establish a current which will stop the reduction. In short, the field current is suddenly increased until the field magneto-

motive force equals the magnetomotive force of armature reaction.

Everything is now in a steady state except that the main flux is slowly decreasing, due to the armature reaction, at a rate just sufficient to induce the electromotive force which drives the extra field current. The extra field current means extra I^2R loss, and thus the magnetic energy of the field is being dissipated as heat in the field resistance. The reduction of the main flux causes a reduction of the generated voltage, and this in turn decreases the armature current, or what is proportional to it, the bucking magnetomotive force. The additional field current now required is less than before, and the rate of decay of the main flux becomes correspondingly less.

The result is that all of these factors, armature current and voltage, flux and field current, which are mutually productive and at the same time mutually destructive, die away together until a permanent state has been reached where the field current is normal and the magnetomotive force of armature reaction leaves

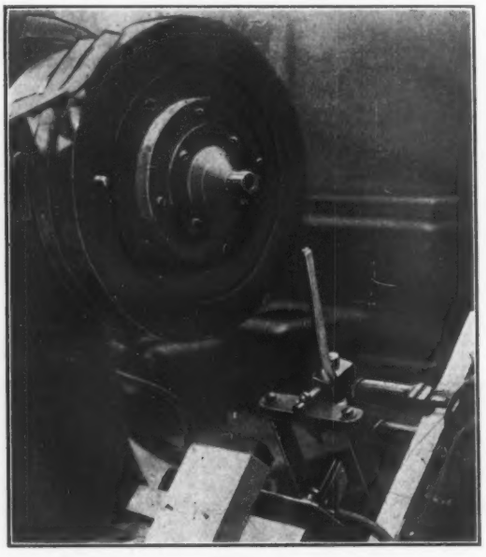


FIG. 2—CLOSE VIEW OF SWITCH CLOSED BY PIN ON END OF GENERATOR SHAFT

just enough flux to produce the voltage which drives the armature current. From these considerations it becomes evident why different machines act differently under short-circuit conditions.

If the generator has salient poles with large spaces between them, the armature is able more quickly and easily to rid itself of the main flux by forcing it out into the air-leakage paths. Furthermore, if the poles are laminated, as is often the case, the reduction of the flux is not opposed by eddy currents. The worst condition seems to obtain in the compact turbo-alternators with non-salient poles which are formed by embedding the field coils in a solid cylinder of forged steel. The flux must largely remain linked with the field and armature conductors in undergoing its reduction. Moreover, the reduction is seriously hindered by the eddy currents induced in the solid mass of the steel core. Against such conditions it is probable that very little can be done to reduce the momentary short-circuit current except the introduction of series reactors.

It is of interest now to consider the effect produced on the first-mentioned type of machine by a modification of the field-circuit constants so as to make the function of this circuit abnormal. The use of a mechanical circuit breaker of any kind is undesirable, and the results must be sought by purely electrical means.

The introduction of external resistance into the field circuit should have little or no effect on the initial

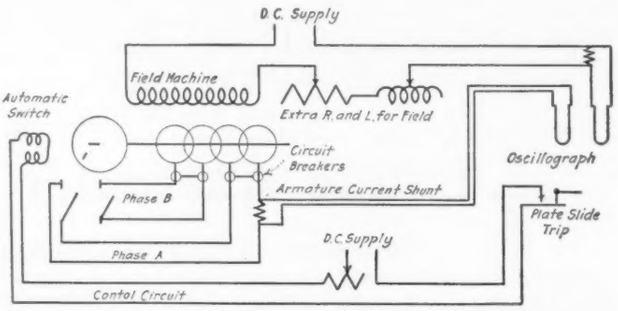


FIG. 3—CONNECTIONS USED IN SHORT-CIRCUIT TEST

value of the armature current. The latter might be reduced slightly, since a greater rate of reduction of the main flux is required to give the electromotive force in the field necessary to drive the extra current. However, since the increased I^2R loss will dissipate the field energy faster, it is to be expected that the total transient will be of shorter duration as the field resistance becomes greater. That is, the permanent short-circuit current will be reached sooner than in the case of the normal field circuit. Such a reduction of the time constant of the transient would have the effect of reducing the heating energy which could be delivered to the short-circuited conductors, but would probably have little effect on the mechanical stresses brought about in the conductors by the initial rush of the current.

If inductance be introduced externally into the field circuit, the sudden increase on the field current at short circuit will be attained only by the production of a very large electromotive force in the field circuit, which in turn will necessitate a large rate of decrease of the main flux and consequently a swift reduction of the generated voltage. Since the worst conditions are prob-

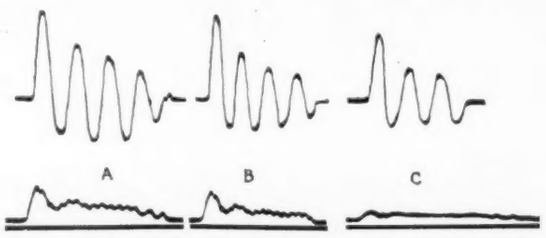


FIG. 4—OSCILLOGRAMS OF ARMATURE AND FIELD CURRENTS DURING SHORT CIRCUIT

The upper oscillograms refer to the armature currents on the asymmetric phase, and the lower oscillograms are the corresponding field currents. *A* is for normal conditions; *B* shows the effect of increasing the field resistance to 340 per cent of the normal value without changing the field current; *C* was taken with an increase to 340 per cent of normal in the field resistance and an increase of 220 per cent of normal in the field inductance, also with normal field current.

ably found in the case where the short circuit occurs at such a time that the current in one of the phases has maximum asymmetry, attention may well be concentrated upon this case as the first one to be considered.

A careful analysis of the relations between the field poles and armature conductors and the transient cur-

rent flowing in them, which may be best carried out by a series of consecutive sketches, will reveal the fact that the phase position of the armature reaction is such that, for the first half cycle after an asymmetric short circuit, the field flux is powerfully bucked by the armature magnetomotive force. Therefore, the flux must have undergone a considerable reduction before the time at which the armature current arrives at its maxi-

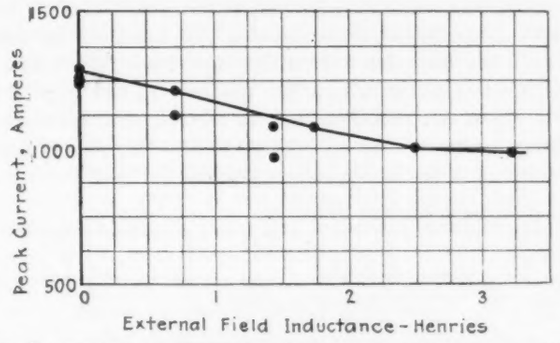


FIG. 5—EFFECT OF EXTERNAL FIELD INDUCTANCE ON SHORT-CIRCUIT CURRENT

mum asymmetric value. That this has been the case is furthermore manifested by the increase in the field current, which, as is shown by the oscillograms to be discussed later, has happened immediately on the closing of the armature circuit. Thus it is not at all impossible that the effect of added inductance in hastening the reduction may make itself felt in time to reduce materially even the first current peak.

It now remains to be shown that the above ideas may be experimentally verified. In running the tests it was necessary to have the conditions identical for each short circuit with regard to the phase position of the circuit closure. This condition was obtained, after considerable trouble with different schemes, by building an automatic, remote-control, synchronous, short-circuiting switch (Fig. 2) which could be closed repeatedly at any chosen point in the cycle. A heavy, non-inductive shunt was placed directly in the armature circuit of one phase and a twin cable of twisted conductors, which eliminated the possibility of inductive interference, was led to a Duddell oscillograph element. The field current was run through another shunt to a second oscillograph element. The photographic plate-slide recording device was so arranged that it automatically closed the control circuit of the synchronous switch at the proper instant so that the plate would receive an impression of the resulting action. Inductance for the field circuit consisted of a number of air-core coils, some semi-closed iron-core coils and the field circuit of another machine which was well below saturation.

After the automatic switches had been set, the generator brought up to full speed and voltage, and the oscillograph adjusted, an observation was taken by merely closing the switch which started the motor running the photographic plate slide. Other operations followed automatically, and the plate registered what happened in the field and armature circuits from the time the short circuit occurred until the circuit breakers on the generator panel were able to clear it. The synchronous switch was so adjusted as to cause a current of maximum asymmetry in the phase being investigated. The data resulting from the tests are represented by the curves in Figs. 4, 5 and 6. In all cases the machine was under no load and at normal frequency and voltage when short-circuited.

The curves serve to check the theory advanced in the first part of this discussion. Curve B, for increased field resistance, starts at about the same maximum value as the normal curve, A, but the decrement is higher and it reaches the steady state considerably before A. Curve D, for the increased resistance and inductance, has a lower initial value and drops more sharply, finally flattening out to join B, with which it coincides after the field flux has been reduced to its final value and the action of the inductance has ceased. Curve C is for less inductance than Curve D. The envelope of the permanent short-circuit current, toward which the curves all converge asymptotically, is indicated by the dashed lines on the right of Fig. 6.

Some tests were also taken, varying the extra inductance in the field circuit, while the field current was kept constant. As shown by the plot (Fig. 5) of the peak value of the initial asymmetric armature current against increased external field inductance, a total reduction of about 25 per cent is obtainable before the curve flattens out. Further reduction by this method is impossible because, as is shown by oscillogram C (Fig. 4), the field-current variation is already reduced practically to zero.

All of the foregoing data were taken with simultaneous short circuits of both phases. A few tests for single-phase short circuit, while not so complete, showed that the effect was of the same nature and of approximately the same order of magnitude.

From the practical standpoint, it is not impossible that there are cases where the introduction of inductance into the field circuit to limit the short-circuit current would be good engineering. The question of whether it may be available in the larger installations where series reactors are now used is one which requires considerable further investigation. The large increase which the field current experiences in the case of some types of big alternators on short circuit indicates that there might be some use for the scheme, but before its economic value can be really determined tests

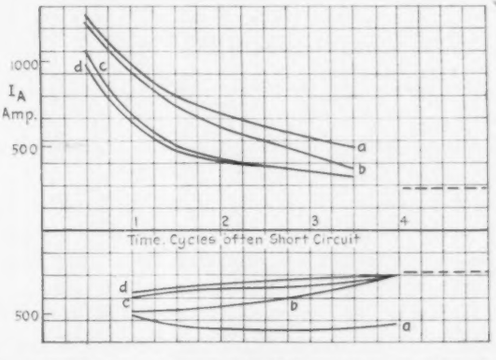


FIG. 6—COMPARISON OF THE ENVELOPES OF THE OSCILLOGRAMS SHOWN IN FIG. 4

on a number of different machines under standard operating conditions are necessary.

The inductances used in the present work were unavoidably of much higher resistance than would be commercially allowable, and the cost of building large inductances of low resistance would be an important economic factor. The results of the present investigation are conclusive in an academic sense only.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STATIC VOLTMETER USED FOR PHASING OUT LINES

High-Voltage Lines Phased Out with This Instrument—Condensers and Voltmeter Suspended from a Switch Stick Near Ground

BY J. R. BALDWIN

A central station company in the South has found that a static voltmeter is a handy apparatus for phasing out high-voltage lines of 50,000 volts and under. Two 22,000-volt lines connected to the same bus at a substation were to be connected together by a 10-mile (16.1-km.) branch line running between substations on each line. The substations are about 15 miles (24.1 km.) from the main distributing point. The branch line was closed at one end and the corresponding phases were tested at the other end, the lines of the same potential showing zero voltage. One terminal of the voltmeter was connected to one wire of the branch line by means of a wire fastened to a switch stick. The other side of the voltmeter was connected by a switch stick to the different wires on the main line until the correct one was shown by the voltmeter reading zero. Three tubular condensers were connected in series and the voltmeter was connected across the middle condenser.

The condensers and voltmeter were suspended from a switch stick near the ground, and two lines were strung between suspension insulators from the tower to supports on the ground. Taps were made from these lines to the meter and the wires fastened to switch sticks were tapped to them on the tower. This made it safe and easy for the linemen.

REGULATOR CONNECTIONS THAT HELP OPERATING CONDITIONS

Switching Arrangements Permitting the Quick Disconnection of Regulator from Circuit in Case Failure Occurs

To prevent outages of any duration in case a regulator should burn out the Pacific Gas & Electric Company has connected its feeders and regulators by double-pole, double-throw disconnecting switches, the series feeder leg being connected to the center of blade, one pair of jaws to the regulator itself and the other pair short-circuited. When it becomes necessary to cut out a regulator, the oil switch is first opened, "killing" the feeder. The double-throw knife switch is then thrown from the regulator side to the short-circuited jaws. Upon opening the primary or teaser switches the regulator is entirely cleared from the circuit and the oil switch can be operated safely. All these operations should not require more than thirty seconds at the most.

This use of the double-throw knife switch was adopted after trouble from regulators burning out which necessitated disconnecting the leads at the regulator itself and short-circuiting the feeder by connecting the two parts where the feeder left the regulator. This operation required the use of tools and insulation, and on some occasions, owing to the misplacing of a wrench or a pocket knife, consumed forty-five minutes

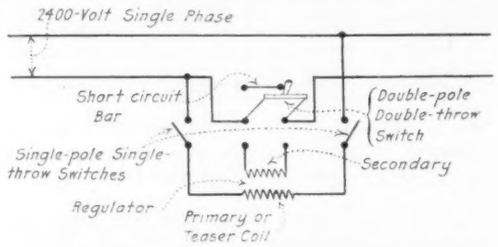


FIG. 1—CONNECTION OF REGULATOR SWITCHES

as against thirty seconds with the knife-switch connection now used.

The present method, however, was developed only after an intermediate step had been tried out. At first one side of the primary or teaser coil was connected directly and permanently to the series leg of the feeder itself, while the other leg of that phase was connected through a link box. Experience showed that with this permanent connection of the teaser coil to the series leg it was not feasible to kill the feeder from a manhole

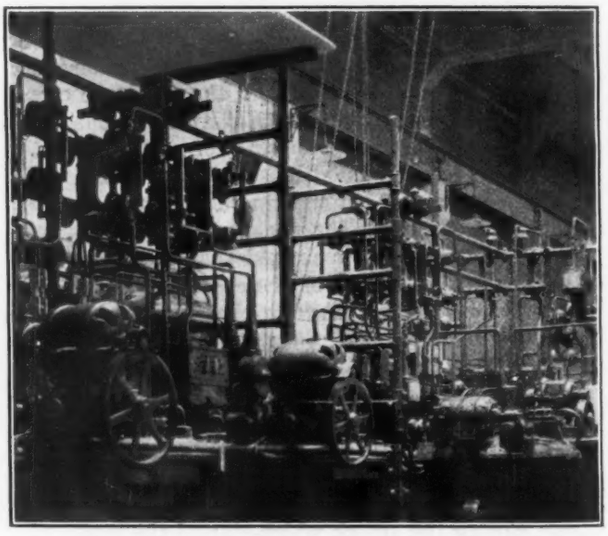


FIG. 2—SWITCHES EMPLOYED TO CUT OUT REGULATORS

junction box because of the dangerous inductive "kick" caused by the primary and secondary being in series when the feeder was energized from another source while the oil switch was open in the particular station in question. To obviate this trouble the permanent connection was done away with and each primary circuit was run through an ordinary knife disconnecting

switch, as described, thus giving the operator control of all connections to the regulator itself.

Important considerations in the reconstruction were additional safety and accessibility. As originally installed above the regulators the switches projected over the passageway, and their combined width, as measured across the power house, was such as to render the operation of the overhead crane in their vicinity dangerous. As reconstructed the spread of the connections is longitudinal with the power house, and the arrangement was made much more compact by placing the switches back to back so that no "live" parts project.

Furthermore, with this construction it was feasible to provide a framework supporting an overhead asbestos panel, which constitutes protection for the entire area occupied by switches and exposed live parts. By making this asbestos cover 5/8 in. (15.9 mm.) thick and keeping the span down to 3 ft. (91.4 cm.), it is safe to allow workmen to stand on the panels when handling crane chains or carrying on other work in which a position above the switches expedites operations.

It is believed by the company that this type of construction will have a lower first cost than that which it replaces, and in building new stations the new arrangement is used.

SAVING RECORDING INSTRUMENT CHARTS

Using Same Chart Twice and Substituting Transparent Paper for Ruled Sheets Is Economical and Convenient

The Rockford (Ill.) Electric Company for some time has been following two plans to reduce the expense for charts for recording instruments. Voltage charts and the like are used twice. For instance, all of the charts used in 1916 were carefully filed and preserved. Now, in 1917, these same charts are being used, with different colored ink, to receive 1917 records from the same instrument and for the same day on which they were used last year. This plan, in addition to effecting some economy, is also advantageous in that it provides each day a record for the station operating force to excel. For some instruments blank sheets of a semi-transparent nature are purchased. These are regularly employed in recording the lines of the instrument pen. Then, if it becomes necessary to read values from the record, the transparent sheet is placed over a ruled record, from which values may be read.

COLD-WEATHER PRECAUTION FOR HYDROELECTRIC PLANTS

Cold Air and Spray Prevented from Entering Gatehouse by Adjustable Barriers Reaching Almost to Water Level

For many winters one Maine hydroelectric plant was bothered with frozen gate riggings. The pond above the gatehouse was wide and long and the cold wind had a clean sweep from three points of the compass. Spray was carried in under the fore-beams of the gatehouse, where it was deposited on the racks and pinions, so that when the remote-control apparatus was energized to raise or lower the gates the motors were usually burned out.

To avoid endless repetition of this trouble a heavily cross-barred door of sheathing was installed so that it can be slid up and down between narrow strips on the up-stream side of each bay. Ropes from each door pass over pulleys to counterweights within easy reach of the station operator. On each shift the door is adjusted to within a few inches of the water, this distance being allowed for variation of head.

The protection afforded by this simple arrangement makes the gatehouse reasonably warm throughout the coldest days and nights, and gate riggings are never frozen now.

CHANGING HORIZONTAL MOTOR TO VERTICAL IN EMERGENCY

Thrust Bearing Made and Lubrication of Bearings Carried Out Without Damaging Windings in 200-Hp., 1800-R.p.m. Motor

When the No. 1 Mine of the American Zinc Company of Tennessee at Mascot was accidentally flooded last spring, suitable pumps were immediately available, but vertical motors to drive them were not to be had any place in the district. Some horizontal motors were available, however, so it was decided to adapt these to vertical operation. The two important problems that presented themselves were how to obtain a suitable thrust bearing to carry the rotor and how to lubricate the bearings in such a manner that the oil would not get into the windings of the motor.

To support the rotor it was first necessary to splice the rotor shaft to make it extend through the end-shield. Accordingly a suspension stud was fitted to the shaft with a right-hand taper thread (the direction of rotation

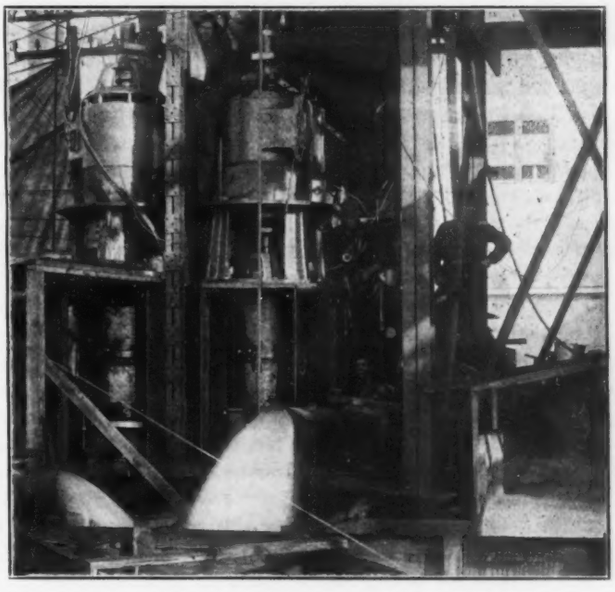


FIG. 1—HORIZONTAL-TYPE MOTORS ADAPTED TO DRIVING VERTICAL-SHAFT PUMPS

of the rotor was opposite). The body of the stud was made the same size as the motor shaft, while the upper end was threaded to receive the suspension nut which carried the rotor. For the thrust bearing a No. 715 U. S. K. F. self-aligning ball bearing was selected. The internal diameter of the ball races was considerably larger than the body of the stud, but a bearing of the

right dimension to carry the load at this speed was not available, and in order to center the ball bearing a shoulder was turned on the suspension nut to take the upper ball race. This was made a snug fit and the bearing performed nicely. The self-aligning washer rested on the end-shield, which was already machined.

Arrangements were made to lubricate first the thrust

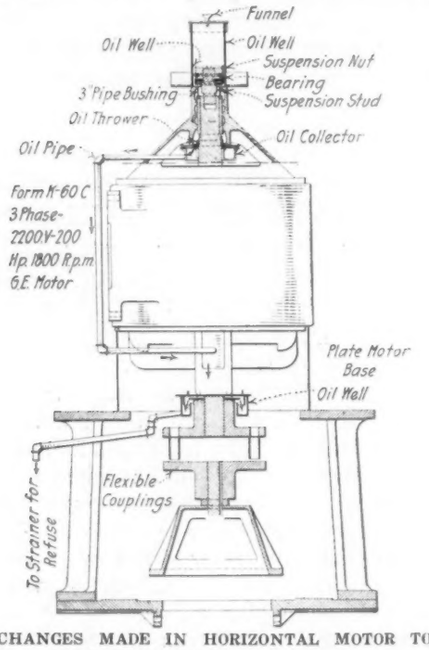


FIG. 2—CHANGES MADE IN HORIZONTAL MOTOR TO PERMIT OPERATION IN VERTICAL POSITION

bearing, then the upper motor bearing, and finally the lower motor bearing. An oil well was made of a short piece of 5-in. (12.7-cm.) pipe screwed into an 8-in. (20.3-cm.) channel to prevent any splash. The channel was bolted to the end-shield with U-bolts that were passed around the arms of the shield. A hole was drilled in the cover of the oil well to receive a funnel-shaped pipe, the bottom of which entered a hole in the suspension stud. The oil supply was taken from an overhead tank and regulated with a petcock. On entering the stud the oil was thrown into the balls of the thrust bearings through a ¼-in. (0.6-cm.) hole. It was then dashed against the wall of the oil well by the revolving parts of the thrust bearing, from which it trickled down into the upper motor bearing.

To prevent oil running over the outside of the bearing bushing and consequently finding its way into the windings, a piece of 3-in. (7.6-cm.) pipe was bored and turned to fill the space between the end of the bushing and the inside of the end-shield casting. The slots in the bushing for the oil rings were filled with babbitt metal. Oil following the rotor shaft is thrown off by a centrifugal device into an oil collector. From this point the oil is piped to the lower bearing.

The oil-ring slots in the lower bearing were also filled with babbitt metal, and a hole was tapped in about the middle of the bushing for the oil pipe coming from the upper bearing. A spiral oil groove was cut in the babbitt to lead the oil to the upper end of the bearing, from which it was allowed to run down the shaft to an oil thrower. The oil which is drained off is filtered and used again. Albert Wettengal and R. P. Immel of the American Zinc Company of Tennessee worked out the foregoing arrangement.

MAKING UPPER SWITCH COMPARTMENTS ACCESSIBLE

Sockets in Facing Switch Structures Support Pipes Carrying Platform—Cleats on Latter Prevent Endwise Slippage

The upper tiers of the switch cells of the Pacific Gas & Electric Company's stations are made accessible by planks supported on 1¼-in. (3.2-cm.) pipe spanning the aisle between tiers and resting in sockets embedded in the concrete. Riveted in the ends of these pipes are bolts with projecting heads which fit into the sockets and hold the pipe firmly in place. This method makes it possible to work on the upper tiers without obstructing the passageway beneath. If the pipe supports are found in the way at any time they can be readily removed without tools. A pair of cleats on the bottom of each plank prevents it from slipping endwise along the pipe.

REPORT ON TRANSMISSION LINE TELEPHONE STATIONS

Ohio Electric Light Association Makes Recommendations for Protection and Use of Telephones on High-Voltage Lines

In the recent report of the transmission and distribution committee of the Ohio Electric Light Association, the following recommendations for telephone stations were brought out. It was pointed out that a telephone station should be located about every 5 miles (8 km.) and at points easily accessible. The station should be so constructed and located as to make it unnecessary for the operator to use an insulated platform before using the telephone circuit. Each station should be kept under lock and key in order that trespassers may in no way come in contact with it.

To obtain the greatest degree of protection the following apparatus should be added:

1. Insulating transformer at each station.
2. Combined double-pole fused switch and lightning arrester at each telephone station on the line side of the insulating transformer.
3. Double-pole horn gap across line at each station on the line side of all apparatus for protection of the insulators in the telephone circuit in case of cross between power and telephone circuits after series fuses are blown.
4. Drainage coils should be installed with fuses at each end and the middle of the line.

Rules for Using Telephone

1. The telephone set, when not in use, should be left connected by a double-pole switch from the circuit.
2. The telephone set should be so connected to the line as to permit the station to be called without having the set connected permanently. This is to be accomplished by an extension bell, removed from the telephone set.
3. The telephone line should be transposed about every 8 miles (12.9 km.) but truly equidistant.
4. The telephone user should be instructed to avoid all metal parts of the telephone set at all times.
5. The power linemen should consider the telephone circuits with the same respect as the high-tension circuits.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

TO TRY OUT NEW CAMPAIGN IN TYPICAL TEST DISTRICT

Representative Section Has Been Selected by Louisville Company to Obtain Experience with 3-Cent Excess Consumption Campaign

Part of the electrical appliance sales campaign which has been begun by the Louisville (Ky.) Gas & Electric Company in connection with the 3-cent rate on excess consumption beyond a given figure (reported in the ELECTRICAL WORLD for June 30 last, page 1263) will be in the rural districts served by the company. In order to obtain the experience likely to insure success for this portion of the drive, the company has selected a small section typical of the greater part of the area concerned, and will give the plan a thorough test there. It is the expectation that the farm and country homes should not only furnish good prospects for the sale of household appliances such as are being sold to the people in the city but that there are many other articles in which the country resident can be interested. Electrically driven pumps, among other things, will be a feature of the drive, while the solicitors will undertake whenever they come upon a gasoline engine to replace it with a meter that will do the same work.

OFFICE ECONOMIES FOR LIGHTING UTILITIES

Savings Effected in Billing Customers' Accounts, with Plan Found Effective for Checking Up Delinquents

BY J. C. M'LAUGHLIN

Manager Commercial Department Potomac Electric Power Company, Washington, D. C.

In the office end of a light and power utility there are opportunities to effect economies. The only possible way to reduce costs in the office is to simplify and to standardize.

Until recently we billed the service for electric energy on the usual blank with a detachable cashier's voucher. The appliances were billed separately. The energy bill has usually been delivered by hand; the supplies bill has gone out by mail. Sometimes two weeks elapsed between the rendering of one bill and the rendering of the other. This meant that in many cases the energy bill would be paid and the supplies bill could go over a month or more. It meant two accounts and the consequent expense attendant upon a duplication of records.

Now we bill both electricity and supplies on a single blank. It means, obviously, reducing the work in the office by one-half and a considerable savings on paper and printing.

A year or so ago we also inaugurated the system of not sending receipted bills except on request. If receipt is desired, the entire bill must be sent with the remittance. If no receipt is desired, the coupon alone will suffice.

We decided upon this plan because of the increasing popularity of paying bills by check. It saves us a great deal of clerical work and a considerable amount in postage. As the indorsed check is evidence of payment and the customer has been provided with a blank at one corner of the bill proper for his own record (showing number of check, name of bank and date), there can be no question of error or misunderstanding if all records are correctly made. Likewise it enables the office staff to trace all bill complaints or inquiries more efficiently.

The system of payment by check is affected by the usual, if somewhat small, percentage of returned checks. Often they are returned by the bank because incorrectly made out, but the usual reason is "insufficient funds." As is known by most business men, the overdraft is chronic with some individuals and must be met as such. Our cashiers in due time become familiar with this class of offenders, and all their checks are laid aside, banked separately, and no bill is receipted until the check has been paid. This avoids the confusion which arises from unpaid accounts marked paid and leaves the matter in the status of "bill rendered" until the bank has accepted the check.

A NEW SYSTEM FOR DELINQUENT ACCOUNTS

We have also devised a new system for delinquent accounts. To begin with, delinquents may be negligent, absent, slow pay or bad pay. Our motto is to pay little attention to the consumers who are really responsible, no matter if in arrears, if the amount is reasonable. It often happens that collection totals look well when our collector's day's work is done, but we judge collections not by total but by the individuals who have paid. If a man who is bad pay has satisfied his bill in full, even though the amount is not more than $10, we consider it better work than if the collection included, instead, a payment of $50 by a man whom we know to be good pay.

"Customers who pay," we say to our collectors, "will pay, sooner or later. It is lost time to go after them so long as there are stubborn cases of bad pay which require your attention."

This question of arrears we have simplified by a new method of checking up which we are now using and which has the advantage of rapidity, efficiency and dependability.

Instead of going over our books at the close of each discount period, as formerly, to see what bills remained unpaid, and making a list of them, tabulating them and sending them to our collection manager—all of which required time and trouble and was not error-proof—we have devised an extra perforated coupon on our bill blanks. In billing, accounts paid up involve no trouble

except the tearing off of the "arrears coupon," while arrears are duly noted in the coupons, and these coupons are torn off and placed in the hands of the collection department before the bills are sent out.

Our new bill blanks, therefore, are in three sections —the bill proper, in which energy consumption and appliances are itemized, besides the discount and the consumer's own marginal blank for payment by check; the cashier's coupon, and the arrears coupon. The blank is made out in one operation and as easily checked up, because all totals must agree. It serves three separate and distinct requirements, which up to the present time involved three records and consequent triplication.

In fact, we are convinced that conservation places upon us the duty of making as much as we can of what we already have on hand and refraining from assuming any additional responsibilities that can be avoided. We find that it pays.

RATE THAT IS DESIGNED TO INCREASE USE OF ENERGY

Customer's Maximum Bill Determined on Square Feet of Floor Space, with 1 Cent per Kilowatt-Hour Charge for Excess.

A primary rate of 5 cents per kilowatt-hour and a secondary rate of 1 cent per kilowatt-hour, with a maximum use on the primary rate based on square feet of floor space, is in operation in Tacoma, Wash., by the city light department. The rate was designed to increase the use of electricity in the home, particularly in the matter of electric cooking.

The maximum rate of 5 cents applies to the first 40 watt-hours consumed monthly per square foot of equiva-

ADDRESS _____ St. _____ Flat _____

NAME _____ Date _____

WORKING SPACE			IDLE SPACE		
ROOMS	DIMENSIONS	SQ. FT.	ROOMS	DIMENSIONS	SQ. FT.
Parlor			Halls		
Living Room					
Library			Bath Rooms		
Dining Room					
Kitchen			Bed Rooms		
Pantry					
Total Sq. Ft.				Total Sq. Ft.	
½ Sq. Ft. Idle part					
Total Sq. Ft. Equivalent Floor Space					

PLEASE FILL OUT AND RETURN SEE OTHER SIDE FOR INSTRUCTIONS

FORM FILLED OUT BY TACOMA ENERGY CONSUMERS

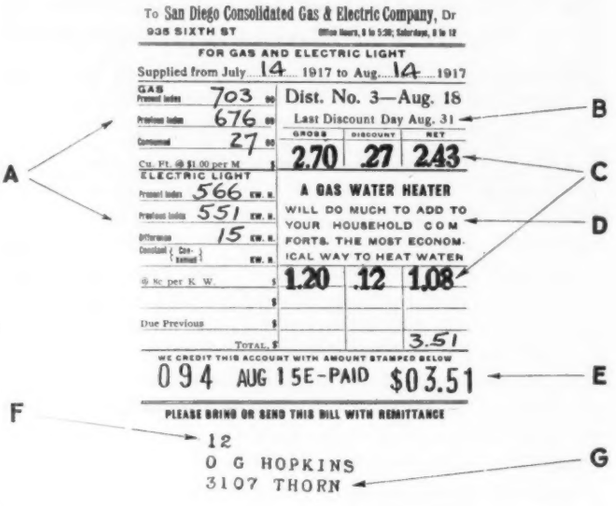
lent floor space. There is also a minimum charge of 50 cents per month. Parlors, living rooms, libraries, dining rooms, kitchens and pantries are considered as working space, and the total square feet in this working space is taken. Halls, bathrooms and bedrooms are classified as "idle space," and only one-half of the total square feet is taken. Basements, attics, clothes closets, porches and outbuildings, unless used for purposes bringing them into one of the above classes, are exempt.

The city light department has furnished a card as shown upon which the customer may record the dimensions of the various rooms. This record must be filed at the department's office before the benefit of the 1-cent rate can be obtained.

ECONOMICAL POST-CARD MONTHLY BILL FORM

Labor and Expense Saved by California Company in Use of Single Card for Both Gas and Electric Accounts

A post-card form of bill has been developed by the San Diego (Cal.) Consolidated Gas & Electric Company which has resulted in a saving both in labor and ex-



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COMBINATION POST-CARD ACCOUNT

pense and which therefore is of particular interest at the present time.

The form has eight features as listed below. The letters denoting these features are used also to illustrate these points on the card.

A. Gas and electric bill combined on a single post card, saving postage, printing and office labor.

B. Discount date in red to bring it out prominently.

C. Amounts printed with rubber stamps, gas in black, electric in red. Rubber stamps arranged in trays of 100 with number of kilowatt-hours (or cubic feet of gas) printed on the wooden back of each. Bookkeeper uses the stamp corresponding to the consumption for the month in question. No errors in extensions or discount deductions.

D. Small advertisement slipped in each month to occupy vacant space.

E. When bill is paid, special cash register stamps amount, date and cashier number in this space and chops off bookkeeper's stub along the double line below; also prints similar information on bookkeeper's stub.

F. Ledger number printed by addressograph, simplifying assorting of stubs.

G. Customer's address is his page number in a loose-leaf ledger. In each district ledger the customers are grouped by street names, the street groups being arranged in alphabetical order, and in each street group the individuals take the serial numbers of their residences. Each customer's sheet covers both gas and electric accounts for four years. There is no difficulty in inserting new accounts in their proper order. As the bookkeeper handles gas and electric accounts simultaneously, bookkeeping is reduced to a minimum.

H. On front of postal in the portion at the left which may be used for correspondence is printed a list of the banks and pay stations at which bills may be paid. Occasionally this space is used for an appliance advertisement.

A CENTRAL STATION COLD-WEATHER SERVICE

Experience of Duquesne Light Company with Electrical Water-Pipe Thawing in Pittsburgh in the Winter of 1916-17

BY JOHN M. ORR

An unusual, unadvertised service is being rendered Pittsburgh people by the Duquesne Light Company. It is seasonal and is, therefore, not so well known by the public as is the furnishing of industrial power, residential or street-lighting service, and its seasonal nature is liable to create a demand which exceeds the means to supply it. That service is electrical water-pipe thawing.

Three or four years ago the light company built a special experimental transformer in its laboratory for pipe thawing and, as the subsequent experiments proved successful, more transformers were added, until now there are six of them distributed within its service radius. These were always sufficient to take care of the work before this year, the winters being comparatively mild, but in February of 1917—during which month the mercury constantly hovered close to the zero mark—so many demands were made by the public that some had to be refused for lack of equipment to do the work.

Electrical thawing is absolutely safe. There is no danger from fire or falling plaster, no dirt to contend with and no delay, and this is how it is done:

The transformer, which is rated at 25 kw., has a ratio of forty to one. The primary side is connected to the regular 2200-volt, single-phase lines, giving the secondary side a capacity of about 450 amp. at 52 volts, on full load. The pipe to be thawed, the gage and a choke coil which limits the current so that a direct short circuit is not caused are connected in series with the secondary of the transformer. The pipe connections are made by attachment to the pipe so as to include the frozen part in the circuit. In an inside freeze one connection is made where the water enters the cellar and one in some other part of the house. In an outside freeze one connection is made in the house and one to the outside line, usually connecting to the water line in the next house, or it has been made in some cases to an adjacent fire plug. It is very important in all cases to have good, firm connections, as a large amount of current flows and high conductivity is essential. Thawing an ordinary house freeze, either inside or outside, is accomplished usually in from two to five minutes.

The degree of heat of the pipe which is being thawed is indicated by a gage, which consists of a piece of lead pipe about 8 in. (20 cm.) long, mounted on the transformer and inserted in the secondary circuit. This is the same size as the pipe used in the house and shows the attendant very accurately the condition of the house pipe, which is never hotter than is comfortable to the touch. No voltmeter or ammeter is used, so that it is impossible to say just how much current flows, but one of the transformers was burned up on a job, which seems to indicate that a considerable amount is used. The spigots are left open, so that the water will flow readily when the ice melts.

Sixty-four thawing jobs were contracted for during February last in the company's service radius, only one of which took an unusually long time, and the supposition is that the pipe was so corroded in the ground that its conductivity was little better than that of the ground.

A few of the unusual and most interesting cases handled by the company follow:

The United States Glass Company requested the company to thaw out an 8-in. (20.32-cm.) water main, 65 ft. (19.81 m.) long. This was frozen rather tight, and it required about six hours to get the water to flow.

A 4-in. (10.16-cm.) water main, 200 ft. (60.96 m.) long, was thawed in twenty-five minutes in Beaver Falls. The ground at that time was frozen to a depth of 2 ft. 10 in. (86.36 cm). The Aspinwall-Delafield Land Company had about 1500 ft. (457 m.) of 2-in. (5.08-cm.) main to thaw in its lot plan. It required about three days to get the water flowing.

Another customer wanted the company to thaw an iron gas line, 800 ft. (243.84 m.) in length, on his farm, but this could not be handled, there being no transformers available at the time of the request.

The Denny Methodist Episcopal Church had planned to hold a big supper in the church and realized just about two days before that the water was frozen. A plumber was called, and he worked for a day and a half without success. The light company was then called, just after the crew in that district had left on its afternoon's work. After much telephoning, the crew was located at 3 o'clock and recalled. A thawing transformer was put on the truck, rushed to the church and water was flowing at 4.45 o'clock, thus enabling the members to hold the supper as they had planned.

One residence was thawed three days in succession. This customer purchased water on a meter basis and was unwilling to allow it to flow all night.

These illustrations show that electrical thawing is past the experimental stage.

Some persons have expressed the opinion that electrical thawing has a bad effect on the pipe, *i. e.*, that it will corrode it or shorten its life in some way. This is not so, inasmuch as electrolysis, which is the cause of pitting and corrosion in pipes, has no chance to take place in such a circuit, it being dependent upon a difference in potential between the conductors, while in the short short-circuit used little or no drop in potential is evident. The opinion as to injuring the pipe has been confirmed, probably, by the fact that in the case of some pipes thawed it was found that they had burst in the ground. As soon as the ice melted the water would run from the leak and, in the absence of a better cause, electricity was blamed. As these cases occur, it is evident that the company is justified in including in its thawing agreement a clause to the effect that it is not responsible for any damage to pipes which may prove defective after thawing.

Summarizing the situation, electrical pipe thawing is desirable business for the central station. It is a true public service and one that is sincerely appreciated and valued by the customer.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Design of Electromagnetic Machines. — Stanley Parker Smith.—Continuation of article started in the June 2, 1916, issue of the *Electrician.* This installment contains discussions on the effect of coil-span factor, distribution factor and group factor on the induced emf. of three-phase windings. Suppression of the third harmonic and tooth effects, the effect of number of slots and phase spread on distribution factor, calculation of the interlinked or terminal pressure, and the virtual value of the induced emf. are other subjects taken up.—London *Electrician,* Aug. 10, 1917.

Lamps and Lighting

Photometric Tests of Floodlighting Projectors.—S. L. E. Rose.—The author outlines commercial tests essential to the determination of the beam candlepower distribution of floodlighting apparatus, and tabulates constants necessary for calculating beam flux in lumens under various conditions. There are two methods that may be used to obtain the distribution of candlepower across the beam: First, the projector may be kept stationary and the photometer moved across the beam from one side to the other. Second, the photometer may remain stationary and the projector be turned on a vertical axis through the light source until the beam has traversed the photometer test plate. Where frequent tests will be required, and especially indoors, the second method will be found preferable. The equipment necessary for the second method is a portable photometer with accessories, a test table adjustable for height and fitted with a revolving top upon which to mount the projector, a curtain or light-colored surface upon which to focus the beam, and necessary screens, ammeter and voltmeter.—*General Elec. Review,* September, 1917.

Road Illumination by Means of Automobile Headlamps.—H. P. Gage.—This article deals with the distribution of light and the intensity of light from the automobile headlamp. Illumination of the road without glare to approaching drivers is the problem that is considered. A number of photographs show the distribution from various headlighting equipments. The author suggests that the regulations governing the glare from headlamps should not only specify the limitations of glare, but also what devices can and what devices cannot be made to eliminate glare when properly adjusted and installed.—*General Elec. Review,* September, 1917.

Generation, Transmission and Distribution

Utilization of Brown Coal.—J. L. Stevens.—First of a series of articles dealing with economical methods of burning lignite as practiced in different parts of the world. This article deals with the subject generally and opens up the question of briquetting. A subsequent article will deal with the use of lignite as a boiler fuel. In central Europe and in Texas lignite is an important fuel, but in other countries where lignite exists and where black coal is relatively cheap and accessible it is not considered important for that use. The erection of an electric power station on the Morwell (Victoria) brown coal field and the driving of the dynamos by engines with some form of lignite is contemplated to supply Melbourne's needs.—*Mining and Engineering Review,* July 5, 1917.

Utilization of Waste Products and Low-Grade Fuels for Power Generation.—John B. C. Kershaw.—Careful study of fuel combustion, says the author, has shown that practically every variety of combustible material can be burned and its heat value converted into the thermal energy of steam, provided, first, that the combustible matter exceeds 65 per cent; second, that the furnace is correctly designed, and, third, that the air supply is properly distributed and proportioned to the needs of the fuel. Methods of securing the last two requirements are discussed and data are presented on actual results obtained with coke and coke-breeze firing.—*Met. and Chem. Eng'g,* Sept. 1, 1917.

Installations, Systems and Appliances

The Vamma Power Station in Norway.—This plant is now being further increased so as to raise the maximum output from the present value of 36,000 hp. up to 60,000 hp. This article describes the region in which the plant is situated and gives a history of the installation. The power station is built on the down-stream side of the dam, to which it is parallel throughout its length. It has been designed to accommodate fifteen main generating units. A by-pass for surplus water is situated to the south of the power station. It consists of a weir with a total length of about 100 m. (328 ft.), part of which is occupied by two roller weirs respectively 20 m. (65.6 ft.) and 28 m. (91.8 ft.) long, which are used to regulate the water level in the reservoir. An additional fixed overflow weir with its crest at a somewhat higher level is also provided. At present the power station will accommodate six 12,000-hp. turbines and two excitation turbines. Three 12,000-hp. turbines and one 500-hp. auxiliary turbine are in use, and two additional 12,000-hp. turbines are being installed. In future developments the power station can be carried further along the dam. The building for instruments, transformers, etc., makes a right angle with the axis of the power station. In the central portion between the two buildings are workshops, storerooms and offices. There will be no difficulty in extending them longitudinally when the necessity arises. The buildings are built entirely of concrete with ferro-concrete roofs.—London *Engineering,* Aug. 10, 1917.

Electrode Cooling.—Haakon Styri.—A simple arrangement for cooling electric-furnace electrodes by water. The cooling water comes through the armored hose to a distributing box, fastened on the outside of

the columns for the electrode holders. Only three pipes go out from the distributing box—one to each electrode—each of which is furnished with a regulating valve. Where the pipe passes the roof ring a piece of rubber hose is inserted for insulation and connected with a union to the pipe which goes to the cooling ring. The return pipe from the cooling ring is connected with a

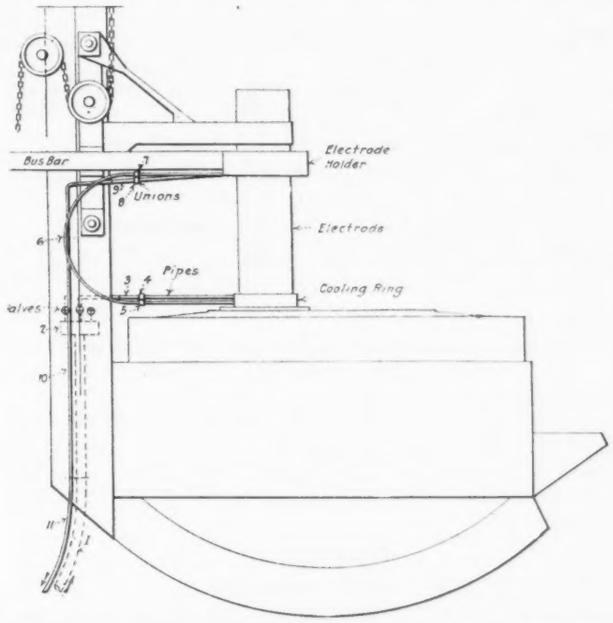


FIG. 1—METHOD OF EQUIPPING ELECTRIC FURNACE ELECTRODES SO THEY MAY BE COOLED BY WATER

union to the rubber hose, which is sufficiently long to allow for total electrode movement and some surplus to prevent kink. This rubber hose is again, by means of a union, fastened to the pipe leading to the electrode holder, and the return pipe from this is, by means of union and rubber hose, connected to the downflow pipe, which is fastened to the electrode carriage. From this pipe the armored rubber hose leads to the common waste-water box.—*Met. and Chem. Eng'g*, Sept. 1, 1917.

Electrophysics and Magnetism

Ionization and Excitation of Radiation by Electron Impact.—BERGEN DAVIS and F. S. GOUCHER.—Description of apparatus and method of conducting experiments to determine the ionizing potentials of mercury vapor and hydrogen and to ascertain whether effects occurring below 10.4 volts are due to ionization or to the emission of ultra-violet light from bombarded atoms. From the experiments with mercury vapor it was concluded that (a) radiation is emitted without ionization at an impact voltage of 4.9 volts. This voltage corresponds to the frequency of the first line $\lambda = 2536.7\ A$ of the Paschen combination $v = 2p - mS$, as has previously been pointed out. (b) An increase in the intensity of the radiation takes place at an impact voltage of about 6.7 volts. This voltage corresponds to the frequency of the first line ($\lambda = 1849\ A$) of the principal series $v = 1.5S - mP$ of this combination. (c) Ionization by impact, without an apparent increase in radiation, occurs at an impact voltage of about 10.4 volts. This voltage corresponds to the head or shortest wave length of this same principal series. From experiments with hydrogen it was concluded that (a) both ionization by impact and emission of radiation occur at 11 volts; (b) a second type of ionization by impact without increase of radiation occurs at about 15.8 volts; (c) a second type of radiation without an increase of ionization is emitted at 13.6 volts.—*Phys. Review*, August, 1917.

Methods for Efficiently Utilizing Fuel Resources.—V. Z. CARACRISTI, S. NAKAYA and J. R. BLAKESLEE.—The first-mentioned author reviews the advantages of pulverized fuel for generating steam, outlines the basis for comparing the cost of this method with the methods more commonly used, and discusses the problems incident to its application to boiler furnaces. The last two authors describe a very interesting power plant where the coal is burned in by-product gas producers in order to recover the large nitrogen content in the form of sulphate of ammonia—a valuable fertilizer. A unique feature is the method of obtaining a supplementary supply of low-pressure steam from turbines, for cooling the producer fires and generating ammonia vapor. This plant supplies electric power for lighting the colliery and for mining purposes.—*Gen. Elec. Review*, September, 1917.

Electrochemistry and Batteries

Electrolytic Zinc.—E. P. MATHEWSON.—(Abstract of paper presented in bulletin of the Canadian Mining Institute.) Western metallurgists now estimate that they can treat the so-called complex ores by the new method, crediting to the process the value from the sale of silver, gold, copper and lead, and producing zinc at a price that will compete with the retort process under normal conditions. The directors of the Anaconda Copper Mining Company were so impressed with this belief that they authorized a series of experiments and constructed a plant that produced 10 tons (9 t.) of zinc per day and later increased this to a capacity of 35 tons (31.5 t.). They then decided to build a modern plant close to the source of power, as this is the principal item of cost in the process, erecting the largest electrolytic zinc refinery in the world at Great Falls, Mont. The plant, as designed, will consist of five units. Late in December three units were in operation, producing 95 tons (85.5 t.) of metal per diem, assaying 99.92 per cent zinc. The completed plant will have a capacity of 160 tons to 175 tons (144 t. to 157.5 t.) of zinc daily. During the experiments in the test plant at Anaconda the process originally proposed by Laist and Frick was much simplified. Some of the details are given in the original paper.—*Mining and Engineering Review*, July 5, 1917.

Electric Steel.—In the July 14 issue of *La Nature* a description is given of the work being carried on at the Keller factory at Livet for the production of "synthetic pig iron." Measured quantities of carbon and silicon are introduced into a molten bath of steel turnings to obtain a steel with a carbon and silicon percentage higher than that finally required. The steel which is worked up is transferred to a refining furnace. With the new method the advantages are two. In the first place, the desulphurized and supercarburized steel, containing any required proportion of silicon, is obtained by continuous fusion, with maximum thermal efficiency, in the electric furnace. The work does not require the employment of specialists, and the energy consumption per ton does not exceed 600 kw.-hr. Second, the refining furnace gives a good yield per hour. The dephosphor-

ization process is carried out in a second operation. A national factory has recently been erected somewhere in France to produce 300 tons per day.—London *Electrician*, Aug. 10, 1917.

Units, Measurements and Instruments

A Condenser Transmitter as a Uniformly Sensitive Instrument for the Absolute Measurement of Sound Intensity.—E. C. WENTE.—A description is given of a transmitter of the electrostatic type which is especially adapted for measurement of sound intensities over a wide range of frequencies. The apparatus when once adjusted may be used for the measurement of the intensities of sound at any frequencies throughout a wide range (0 to 10,000 cycles per second) without further special adjustment. Owing to the uniform response through this wide frequency range it will be possible to secure correct indications of complex wave forms and to determine not only the relative intensities of the components but also their phase differences. When properly calibrated this apparatus can be used as a precision source of sound.—*Phys. Review*, July, 1917.

A Study of Electromagnet Moving-Coil Galvanometers for Use in Alternating-Current Measurements.—ERNEST WEIBEL.—The author discusses mathematically the principles underlying the construction of moving-coil instruments for alternating currents and describes the construction of four different galvanometers of this type. Finally he discusses their values as detectors, for the measurement of inductance and capacity and other special uses.—London *Electrician*, Aug. 10, 1917.

Influence of Radiation on Fire Temperature.—DEINLEIN.—For a given rate of combustion the radiation ratio σ is practically independent of the fuel. When the rate of combustion is 100 kg. per sq. m., $\sigma = 27$ per cent (ca.); i.e., about 27 per cent of the thermal value of the fuel is conveyed to the heating surface by radiation. At 25 kg. per sq. m. the radiation ratio increases to 44 per cent. The radiation ratio is higher the lower the rate of combustion, and from the relation between fire temperature and radiation ratio it follows that the latter (for a given fire temperature) is higher the better the fuel used. A formula is given in the original paper whereby this ratio may be calculated from easily obtained measurements.—*Science Abstracts*, Section B, May, 1917. (Abstracted from *Zeits. d. Bayerisch. Revisionsver.*, July 31, 1916, and *Elektr. u. Masch.*, Jan. 7, 1917.)

Telegraphy, Telephony and Signals

Multiplexing in Cable Telegraphy.—GEORGE D. SQUIER.—Plan proposed for using two separate cables, one for sending and the other for receiving, thereby removing the difficulties from balancing and greatly increasing the working capacities of the cables. Local transmitting circuits are coupled to the cable, the frequency of each transmitter being different from any one of the others, say, 6, 8 and 10 cycles. In each local transmitting circuit two loop circuits are included which are separately tuned to the frequencies of the other two transmitters, offering thereby a high impedance to the current flow at these frequencies, thus preventing the transfer of current from one transmitting circuit to the others. To further check any transfer of current from one local circuit to another, intermediate circuits are introduced through which emfs. of opposite phase to that induced by cable transformers are made to balance any residual effect. Each receiving circuit is coupled to the cable through an intermediate circuit. In each intermediate circuit two loop circuits are included which are separately tuned to the frequencies of the signals which are to be excluded from that particular receiver, each receiver responding accordingly

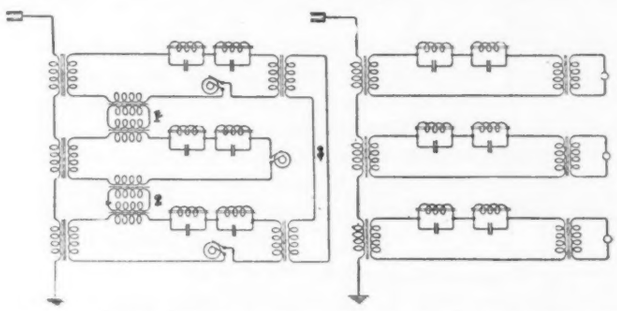


FIG. 2—ARRANGEMENT OF SENDING AND RECEIVING TERMINAL EQUIPPED FOR MULTIPLEX TELEGRAPHY

only to a signal of one predetermined frequency and excluding the others. Loop circuits may also be introduced in the receiver circuits, and thus further increase the selectivity of the method.—*Journal of the Franklin Institute.*

Miscellaneous

Reflecting Power of Tungsten and Stellite.—W. W. COBLENTZ and W. B. EMERSON.—This paper gives the results of a critical examination of the reflecting power of tungsten in the region of the spectrum from 0.5 μ to 6 μ. The reflecting power of tungsten in the form of plain, highly polished mirrors is determined by comparison with silver and by a new method employing a total-reflection prism. The results obtained are based upon an examination of three samples of pure tungsten and a sample of unknown purity. All samples show a marked depression in the reflectivity curve at 0.8 μ. A similar indentation occurs at 1.3 μ in the reflectivity of the pure metal, but it is absent in a sample of impure tungsten. The reflecting power curve of pure tungsten rises abruptly from 50 per cent at 0.5 μ to 90 per cent at 2 μ, beyond which the reflectivity increases gradually to about 96 per cent at 6 μ. The bands of selective reflection at 0.8 μ and 1.3 μ render tungsten conspicuous as being the only pure metal thus far investigated which has bands of selective reflection in the infra-red region of the spectrum. The minimum of reflection at 0.9 μ causes a perceptible protuberance in the emission spectrum of an incandescent tungsten filament. The reflection power of stellite rises gradually from 65 per cent at 0.6 μ to 88 per cent at 9 μ.—*Scientific Paper No.* 308. Bureau of Standards.

The Thermophone as a Precision Source of Sound.—H. D. ARNOLD and I. B. CRANDALL.—The writers have found that the thermophone, together with a suitable supply of alternating current, can be used conveniently as a precision source of sound energy. A description of a simple thermophone structure is given, together with the theory of its operation. From experiments therewith the authors are led to believe that the thermophone is adapted to two classes of service: (a) As a precision source of sound at any frequency; (b) as a source of sound of known relative loudness at different frequencies throughout the acoustic range. —*Phys. Review*, July, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

OPPORTUNITIES IN RUSSIA FOR ELECTRICAL MATERIALS

M. A. Oudin, Returning from the Far East, Believes that with Stable Government the New Republic Offers Great Prospects

M. A. Oudin, manager foreign department General Electric Company, has returned recently from a trip to Russia, Japan and China. He was away from home seven months and was in Petrograd at the time of the historic revolution.

Mr. Oudin made his trip in order to investigate the possibilities of Russian markets for American electrical apparatus. In the past the market in Russia for American products has been very limited on account of the proximity of Germany to that country. Germany's commercial domination over Russia was almost complete. Electrical industries, both manufacturing and selling, were almost entirely in the hands of the large German companies.

"Now," said Mr. Oudin to a representative of the ELECTRICAL WORLD, "all of the German interests in every line have been liquidated by the Russian government and Russian industry is completely free from the stigma of German influence.

"Russia is destined to be free from the German yoke in every possible way and is encouraging American capital and American business methods. Russia invites the technical experience and assistance of the United States to help in developing its industries and resources.

"I think that the field for American electrical manufacturers in Russia will be extended very widely as a result of the revolution and the elimination of Germany. The Russian market is not different from any other European market; its possibilities have to be developed in the same way. At present all exports to Russia are hampered badly by lack of tonnage and distribution facilities. Russian progress is handicapped tremendously by lack of railway equipment. For instance, the port of Vladivostock is glutted with supplies. The Stevens railway commission is effecting rapid improvement, however, in that situation.

"It seems to me that after the war the recuperation of Russia from the ravages of the conflict will be as rapid as that of any nation in Europe. Given a stable government and fixed national policies, I believe that Russia will have a very great industrial expansion. This means that the electrical requirements of Russia will approximate those of the United States twenty-five years ago. Electrical development in Russia will follow lines parallel with those of our own development in the last decade of the nineteenth century. Russia must have capital for development of its industries, and the country which promises the most capital on the easiest terms will be favored with the corresponding business.

"Always predicating forecasts upon the continued existence of a stable government, it is my opinion that almost any well-conceived and well-managed industrial enterprise in Russia will succeed. There may be ups and downs in the progress of such enterprises, but eventually they should be successful."

Mr. Oudin said that with the people of Russia the revolution is the great fact, the war is an incident. He walked in the crowded streets of Petrograd, where there were occasional clashes and many people were killed, but said that in its almost instantaneous accomplishment the revolution resembled more a coup d'état than anything else. The situation is apparently improving, Mr. Oudin added, because the solid element in the cities and the country is beginning to assert itself. He believes that this movement will influence those who are in power so that they will realize that all the people are not extreme socialists.

In speaking of the great stimulus to industry which has been given to Japan by the war, Mr. Oudin said: "Japan appears to be and in reality is to-day a most prosperous country, notwithstanding that it is engaged in war. It is estimated that the war has made fifty millionaires in Japan. The importation of electrical machinery of large size is extensive, and the output of factories of all kinds has practically doubled in the last two years. In many lines the efforts of Japan are confined mostly to meeting internal demands, but when the requirements of its domestic markets are lessened it will be more strenuous than ever in the markets of the world.

"The results of the war will be of very great advantage to China, because it is now arrayed on the side of those nations that have declared for the democratization of government and have maintained that weaker countries should be permitted to carry on their own national life unmolested."

MUNICIPAL ELECTRICIANS ARE TO HOLD CONVENTION

International Association Will Meet in Niagara Falls Sept. 11 to 14 and Discuss a Number of Topics

The convention of the International Association of Municipal Electricians is to be held at the International Hotel, Niagara Falls, N. Y., on Sept. 11 to 14. Among the subjects on the program are: "Practical City Street Lighting," "Renewable Type of Inclosed Fuses," "Growing Tendency Toward Surface Wiring for the Sake of Flexibility and Economy in Many Classes of Buildings," "Fire Hazards of Domestic Electrical Appliances," "Flashlight Signal Systems," "Wireless Apparatus," and "Police Signaling as Affecting the Municipal Electrician."

EXCESS PROFITS TAX IN WAR REVENUE BILL

Speaker Clark of House of Representatives and Senator Simmons Think that Industry Will Not Be Halted

The Senate has got through with the excess profits section of the war revenue tax bill. The result is that, according to the best judgment obtainable in Washington, the House of Representatives will not alter the proposed law as the Senate has framed it.

Champ Clark, Speaker of the House, explained through the Washington correspondent of the ELECTRICAL WORLD during the last week that no one can tell what the House may do in regard to the war revenue bill when it comes across from the Senate.

"This bill," the Speaker said, "left the House of Representatives containing taxes of about 16 per cent on excess profits, considering deductions and exemption. No human being knows what the House of Representatives will do about anything. It is my personal opinion that the majority of the members of the House believe that every manufacturer in the United States is now making a profit of 100 per cent. Of course this is not true. We intend in the House, when the war revenue bill reaches us, to be very careful to see that there shall be enough money left for the maintenance of industry, no matter what the taxes which shall be imposed may be."

Senator Simmons, chairman of the Senate finance committee, explained to the correspondent of the ELECTRICAL WORLD that the committee had again obtained control of the Senate, notwithstanding the remarkable debates on the Senate floor during the last few weeks. Under some of these debates, during which Senator La Follette and other Senators proposed to tax industry to the extent of 80 per cent, it was thought for a time that industry might be halted.

"When we finally passed the excess profits tax provision of the war revenue bill," Senator Simmons said, "we did so after having voted down every amendment that Senator La Follette and other Senators tried to fasten to this bill. The excess profits tax as it stands in the Senate bill now ranges from 12 to 60 per cent. We believe that we have done the very best we can to protect industry."

CANADIAN INVESTIGATION ON HYDRO-ELECTRIC POWER

Commissioners Appointed to Report on Energy and Sale Questions Affecting Electrical Development Company of Ontario, Ltd.

Under the public inquiries act three commissioners have been appointed to investigate and report on the Electrical Development Company of Ontario, Ltd., as follows: Chief Justice Sir William R. Meredith, Justice R. F. Sutherland and Justice T. Kelly.

Their report is to cover the quantity of water in cubic feet per second which the Electrical Development Company is entitled to divert or use, the amount of power in horsepower which such company is entitled to generate or develop, the extent, if any, by which the capacity of the works installed or equipped by such company may be developed, and the price and terms and conditions upon which the power to the extent of such excess should be delivered to the Hydro-Electric Power Commission of Ontario.

The appointment of the commission by the Attorney General of the Province of Ontario follows the statement that engineers for the Hydroelectric Commission and the Ontario government have reported an alleged illegal diversion of water from the Niagara River at Niagara Falls, Ont., by the Electrical Development Company and the Canadian-Niagara Power Company of that place.

ELECTRIC CAMP SERVICE AT HATTIESBURG, MISS.

Local Company to Supply Militia Camp with Lighting Service and Energy for Pumping Water—Output Doubled

The Hattiesburg (Miss.) Traction Company, a subsidiary of the Doherty organization, will supply the militia camp at Hattiesburg with lighting service and power for pumping water.

Present plans call for a 250-kw. power load with an 80 per cent load factor and a lighting load of 400 kw. There will be 300 mess halls, 10,800 electric light outlets, and 200 street series lamps of 100 cp. This means that the Hattiesburg plant will take on an additional load equal to the one it was furnishing to the city before the cantonment was constructed. As the plant has ample generating capacity, the 100 per cent increase will be made without difficulty.

WAR CONTRIBUTIONS FROM THE INDUSTRY

Additional Figures Showing Liberty Loan and Red Cross Subscriptions and Number of Registered Men

In addition to the figures published in last week's issue of the ELECTRICAL WORLD showing the subscriptions of the electrical industry to the Liberty Loan and to the Red Cross funds, together with the number of men registered under the selective draft, the following figures were received. The figures from the six companies give a total of $120,900 Liberty Loan subscriptions, $2,128 to the American Red Cross, and 311 men registered. Already these companies have lost eighty-one men who have entered national service.

Name of Company	Liberty Loan Subscription	Red Cross Subscription	Listed and Drafted
Albert Emanuel Properties, Dayton, Ohio.	$3,600	$762	19
Central Illinois Pub. Ser. Co., Mattoon, Ill.	3,800	516	271
Pacific Gas & Electric Co., Phoenix, Ariz.	1,500	....	6
Puget Sound Elec. Ry. Co., Tacoma, Wash.	11,500	750	...
Rome (Ga.) Railway & Light Company..	500	100	15
Utica (N. Y.) Gas & Electric Co.....	100,000	....	...

Consolidation of Mansfield Properties of Cities Service Company

The Cities Service Company, which controls the Mansfield (Ohio) Electric Light & Power Company, has bought control also of the Mansfield Railway, Light & Power Company. These properties will be combined with the gas utility, which is also controlled by the Cities Service Company.

OUTLOOK FOR COAL SUPPLY IN CITY OF INDIANAPOLIS

Merchants' Heat & Light Company, Although Near Indiana Fields, Will Try to Start Winter with Thirty to Forty Days' Supply

G. W. Hubley, general manager and chief engineer Merchants' Heat & Light Company, Indianapolis, in writing to the ELECTRICAL WORLD in answer to an inquiry about the coal situation, says:

We have joined with the other companies of the Indiana association in asking authority to make a temporary surcharge upon all our electric and heating service bills. This matter has had hearing before the Public Service Commission, and its decision is expected to be given at an early date. [As reported in this issue, some relief has been granted. —EDS.]

In making new contracts for large power business, however, we have developed a "coal clause" for protection of both the consumer and the company in case of variation of the prevailing contract rates for coal. The basis of this "coal clause" recognizes that the cost of coal represents two-thirds of the cost of the energy at the switchboard, and the rate is based squarely on this premise; therefore the rate for service to be billed to the consumer will automatically adjust itself according to the cost of coal.

In view of our experience last winter in which we had many difficulties in the matter of coal deliveries, we are apprehensive of similar troubles in the coming cold season, and especially in view of the railroad operating conditions and the possible complications that may result from the war movements.

Just now we are at the easiest point, but with the approach of the heavy fall traffic and the more serious conditions of operation during the winter months, in addition to the unknown effects of abnormal movements that may occur as a result of the war situation, the prospect for coal supply is not an encouraging one.

However, we are making preparations and taking every precaution to protect ourselves against embarrassment, even under conditions of stress or unusual demands, and it will be our effort to provide a sufficient supply of coal at the start of winter to take care of our requirements covering a period of from thirty to forty days by having about 30,000 tons placed in storage, and with such a reserve, in view of the fact that our plants are so near the coal fields of Indiana, we feel that we shall be amply protected to take care of the demands of our service.

WASHINGTON RATE REDUCTION HALTED BY COURT INJUNCTION

District of Columbia Supreme Court Directs Company to Keep Record of Differences Until Higher Courts Pass on Valuation

An injunction has been issued by Justice Gould in the District of Columbia Supreme Court restraining the Public Utilities Commission from enforcing new rates until the courts have passed upon the appeal of the Potomac Electric Power Company from the valuation of its property by the commission. The company is directed to keep a record of the differences between the rate charged and that ordered by the commission and to refund this to consumers, plus 6 per cent interest, if the valuation is sustained by the higher courts.

Justice Gould pointed out that if the new rate, reducing the cost from 10 to 8 cents per kilowatt-hour to the individual consumer, should be found unreasonable by the United States Supreme Court, and no temporary injunction had been issued, the company would have been compelled to receive each year approximately $350,000 less, and since the final settlement might require as much as three years, it would lose $1,000,000 or more which it would have no means to recover except through individual suits against 30,000 or more consumers.

PROBLEM OF POWER IN KANSAS CITY, MO.

Meeting of Company Officials with Business Men and City Authorities for the Purpose of Considering Shortage of Energy

The right of a public utility to expect sympathy and help from the public in working out problems that affect the public as much as the company was declared at a meeting of business men and city officials with officials of the Kansas City Railways and the Kansas City Light & Power Company in Kansas City on Aug. 28. The meeting was called by Acting Mayor Albert I. Beach, at the instance of Clyde Taylor, acting president Kansas City Railways.

The Railways company had taken off sixty-five cars in order that a small amount of energy might be available for large power users at the morning and evening peak hours. There had been a disposition to charge improper motives. It was shown that of the 39,000 kw. produced by the Railways company plants only 1280 kw. was taken by large power users in the morning and evening, some of them taking scarcely 5 per cent of their normal requirements, and all of them shifting work and reducing production so that cars could be run.

The large power users had made the sacrifice because it was impossible to reduce the consumption of residences and small plants, and it was not feasible to cut car service further. By Nov. 1, with new equipment now being delivered and installed, the Light & Power company will be able to care for most of its load. Temporarily the company continues to get most of the energy for its customers from the Railways company.

The problem, as presented by several speakers, resolved itself into a question of justice and expediency as between deprivation of the large power users and the electric railway patrons. It was pointed out that if power users were cut off many thousand men would be idle and there would be less need for cars. To give power users a small amount of energy meant simply inconvenience for passengers. The committee, headed by R. L. Redpath, which had worked out the schedule for use of specified amounts of energy at various hours by large industries, was asked by those who attended the meeting to confer with the board of control of the railway and arrive at a just distribution between power users and railway patrons of the additional energy which it is expected will be available, through repairs and new installations, during the next four weeks.

During a review of the efforts of the Light & Power company to get equipment, President Lucas touched on the dilemma in which the company found itself because of war conditions. He told of the purchase of a site for the new power plant. Then he intimated that if the Public Service Commission, upon having the subject presented, should indicate that it would later allow full value in capitalization for equipment bought at present prices, the company might proceed at once with plans for the station. He intimated that without some such assurance it would be hazardous to spend now twice as much money as the equipment might cost later.

POWER INTERCONNECTION IN GREATER NEW YORK

Recommendation to Public Service Commission by Gibbs & Hill for Interconnection of New York Edison and Railway Systems

A recommendation for interconnection of the power houses of the New York Edison Company, the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company properties has been made by Gibbs & Hill. As advisers on power matters to the New York Public Service Commission, First District, they made this recommendation some time ago, and the fact was brought out at a hearing on Sept. 4 at which questions connected with the suspension of subway operation on Aug. 25, because of coal shortage, were considered.

The commission will pass an order requiring the Interborough company to maintain a reserve of at least 4000 tons (3600 t.) at the East Seventy-fourth Street power house, which supplies the elevated lines.

CONSERVATION IN GEORGIA BY HYDROELECTRIC CONSTRUCTION

President Arkwright of the Georgia Railway & Power Company Shows Great Value of Water Power

Fuel conservation through hydroelectric construction was urged by P. S. Arkwright, president Georgia Railway & Power Company, in his presentation before the Georgia Railroad Commission of the development plans for which it is asking authority to borrow $2,500,000. Mr. Arkwright said in part:

The nation's most urgent needs at the present time (and for some time past) are conceded to be coal, labor or man power, transportation facilities and food. These needs have been intensified and rendered more acute by reason of the country's having been drawn into war.

It is constantly being impressed upon the people that it is absolutely essential to the success of the nation in the conduct of the war to increase and conserve its fuel supply and food supply and to conserve its labor supply and transportation facilities, as under present conditions the latter two cannot be increased materially, at least during the period of the war.

The Georgia Railway & Power Company proposes to add to its hydroelectric generating capacity 195,530,000 kw.-hr. per annum. An idea of what this means in the conservation of coal, the release of transportation facilities and the conservation and release of labor or man power, which could be more advantageously used in other industrial and agricultural pursuits, may be had from the following:

In the average central steam generating station in the Southeast it requires approximately 3 lb. (1.3 kg.) of coal to produce 1 kw.-hr. of electrical energy. On this basis, 195,530,000 kw.-hr. would equal the available effective energy of 293,295 tons (263,966 t.) of coal, or 7332 cars of 40 tons (36 t.) each.

Assuming that a coal car will make one round trip per month between the mine and the point of destination of the coal (which seems to be a liberal estimate of the performance on an average, when allowance is made for delay in transit, loading at mines, unloading at destination and the time necessary for repair and return of car to mines), it would take 661 coal cars in regular service to haul the coal necessary to produce the energy that the proposed additional water-power capacity will be capable of producing

According to the statistics of the Bureau of Mines, it is estimated that the total labor required for the consumption of every 1000 tons (900 t.) of coal in central steam stations on the basis of one year's time is 2.78 men. This means that from the mine to the final landing of the coal in the ash pile it would require 823 men, working regularly every day, to handle the coal necessary to produce in central steam stations the power that the proposed new developments will be capable of producing. It will require about twelve men to operate the proposed new developments, so that the annual saving in man power by the proposed developments will be at least 811 men. The total saving would be:

In coal per annum, tons	293,295
Release of coal cars (611 per month)	7,332
Release of locomotives	245
Release of labor, regularly, number of men	811

ATTACK ON AMERICAN ENGINEER HAS INTERNATIONAL INTEREST

J. E. Popper, in Charge of Government Electric Central Station at Mukden, Assaulted by Japanese Coolies, Fails to Receive Satisfaction

A case of international interest and importance, involving an American engineer who was assaulted by Japanese coolies, has been taken up with the State Department at Washington.

J. E. Popper, an American engineer and official in the employ of the Chinese provincial government of Mukden, was assaulted by Japanese coolies on Aug. 30, 1916. He is in charge of the operation of the government electric central station at that point. While riding in a jinrikisha he saw that several linemen in the employ of the Mukden Electric Works were being molested by Japanese coolies. He warned the assailants to stop, and they turned on him, clubbing and beating him until they were frightened away by the appearance of the American Vice Consul, who had been called by one of the workmen.

The American and Japanese Consuls General corresponded about the incident. The latter offered an apology, which would have been accepted, but it was never made. The Japanese Consul General then asked Mr. Popper to try the case in the Japanese Consular Court

Before trial of the case in court the official interpreter and a Japanese lawyer whom Mr. Popper had secured after difficulty asked if there was any way by which the case might be settled without trial. Mr. Popper did not wish to have the men unduly punished, but said that the attack had been unprovoked and that since all foreign and American residents were interested he would prefer that the trial go on.

To the amazement of Mr. Popper the court was adjourned immediately after it had been convened. Mr. Popper's attorney declared to the court, so Mr. Popper, who does not understand Japanese, learned afterward, that his client had withdrawn the charge. The American Consul, on hearing of this collusion, demanded reconsideration of the case. The Japanese Consul General said that this was impossible, as the case had been closed. After some correspondence the Japanese Consul General finally advised the American authorities that the time within which Mr. Popper might have appealed had gone by and that nothing further could be done. As similar efforts at Tokio yielded no satisfaction, the case has been taken up directly with the State Department at Washington.

Foreigners in the Far East are watching this case, as its disposal will indicate the character of the justice to be expected of Japanese officials in Manchuria.

HOUSTON COMPANY WORK TO SERVE CAMP LOGAN

General Superintendent Frank G. Frost Gives Details of Construction and Service Plans for National Guard Cantonment

A letter to the ELECTRICAL WORLD from Frank G. Frost, general superintendent Houston (Tex.) Lighting & Power Company 1905, gives the following details of work on Camp Logan, the National Guard cantonment at that place:

Houston was selected as one of the sites for a National Guard cantonment, which was named Camp Logan, on June 12. This company was not able to learn the electrical requirements until July 16, when we were advised to prepare for maximum demand of 600 kw.

Camp Logan is west of the city limits and approximately 8 miles (12.8 km.) from our power station, and it was necessary to build a new line to provide 600 kw. demand at the camp. The company had in stock practically enough wire to build this line, but it was necessary to place an order for a few long poles and transformers for the camp end of the line. It is proposed to transmit this power at 11,200 volts to a substation in the camp grounds, using 6600/2200-volt transformers, Y-connected on the high side and delta-connected on the low side and from the substation, to transmit energy for lighting and power in the camp grounds at 2200 volts. Orders were placed on Aug. 18 for all material that could not be obtained from the company's storeroom.

When the order was placed for transformers and other material for a line from our power station to Camp Logan, there was talk of National Guardsmen beginning to assemble at the camp about the middle of August, and it was realized that it would be impossible for the new line to be completed in this time. This company had service to the camp site, but the circuit serving this territory was loaded to the limit and the branch line to the camp was inadequate to carry sufficient energy for any considerable quantity of camp lighting or power. Also, the city of Houston was drilling a well for water supply for the camp just inside the city limits and approximately 100 kw. would be required at this well. By increasing copper in an adjacent circuit load was taken from the circuit to the camp, additional copper was put up on the branch line to the camp, arrangements were made for approximately 400 kw. at the camp, and the first service connection was made on the evening of July 28.

The new line to the camp will be completed about Sept. 20, and we are advised by the cantonment construction quartermaster that 400 kw. demand will be sufficient for their requirements until the new line is completed.

A contract was made between this company and the cantonment construction quartermaster on July 30 to construct all lines, wire all buildings, tents, street lighting, etc, that will be required inside the camp grounds. There will be a total of 295 mess halls, 295 shower baths, 295 latrines, 30 warehouses and 4222 tents to be wired. All the mess halls are 20 ft. (6 m.) wide and range in length from 49 ft. to 133 ft. (14.9 m. to 40.5 m.), and they will have from eleven to nineteen outlets in each building. The shower baths and latrines will have from one to two outlets in each building. Each tent will be provided with one outlet. There will be approximately 145 100 cp., 6.6-amp. series lamps to light the roadways throughout the camp. These series lamps will be served from constant-current pole-type transformer.

The camp site is covered with a sparse growth of pines which will make suitable poles for line construction, but treated poles will be used for corners and transformer poles. On the morning of July 31 laborers were put to work cutting these trees, shaving and framing them for the pole lines throughout the camp. On the morning of Aug. 1 groundmen were started to work digging holes, and the line work and building wiring have been progressing steadily.

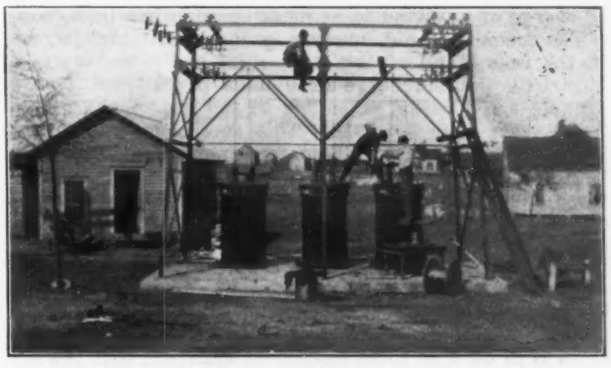
This company does not make a practice of doing inside wiring, but on this job as soon as the contract was entered into all of the available inside wiremen in Houston and vicinity were requisitioned and put to work wiring mess halls, shower baths and latrines. Since work was started inside the camp all men have been worked ten hours per day, including Sunday, overtime being allowed for all over eight hours' work. It is now estimated that construction work inside the camp grounds is approximately 70 per cent completed, and the cantonment quartermaster and other government officials have stated that they are well satisfied with the progress.

The greater portion of all the material for the lines inside the camp grounds was purchased locally by the company's purchasing department. Every employee connected with the company has been busily engaged since work was started on lines and service for the cantonment.

ELECTRICAL CONSTRUCTION AT THE DEMING (N. M.) CAMP

Manager James A. Shepard Says that Owing to Delay in Securing Material Work Has Not Progressed Rapidly

J. A. Shepard, manager Deming (N. M.) Ice & Electric Company, in a letter to the ELECTRICAL WORLD gives the following information in regard to the elec-



TYPICAL EXAMPLE OF RAPID CONSTRUCTION WORK FOR UNITED STATES CANTONMENTS

trical work in connection with the National Guard camp at Deming:

Owing to the delay in securing material the electrical construction has not advanced very rapidly and not very much difficulty has been experienced in securing enough labor for the small gangs needed.

The boundary of the camp is only about five-eighths of a mile (1 km.) from this company's power house, the camp extending about 2 miles (3.2 km.) farther. This company did quite a little work in covering a portion of the camp last year, when 3000 National Guard troops were here during the Mexican trouble, and all of the work done then was available for temporary lighting and the contractors' power requirements.

Our plans are to install two separate circuits supplying current at 2300 volts, the same to be metered and controlled at the boundary of the reservation. The government will take care of all distribution at this point. The preliminary estimate called for a connected lighting load of about 375 kw. and a power load of possibly 100 kw. connected, consisting altogether of pumps for water supply and fire protection. The Mountain States Telephone & Telegraph Company has installed a two or three position switchboard and office on the reservation and has built most of the distributing system in cable. The pole line of this company follows the main highways throughout the camp and is built of 35-ft. (10.6-m.) poles. The government will use this pole line jointly for the main distributing system.

So far we have been able to take care of all requirements for service and believe that we shall be able to get through satisfactorily, although it involves the installation of some 400 hp. in additional boilers.

INDIANAPOLIS RATES RAISED BY THE INDIANA COMMISSION

Small Consumers Not Affected, but Temporary Surcharge of 5 Mills per Kilowatt-Hour Put on Large Customers

The Indiana Public Service Commission, in an order which takes up the underlying reasons for high operating costs, has granted the petition of the Indianapolis Light & Heat Company and Merchants' Heat & Light Company of Indianapolis for authority to increase revenues. While the commission denied authority to add a surcharge to the 50,000 small consumers each month, it granted a horizontal increase on large power and light consumers.

E. I. Lewis, chairman of the commission, summed up points in the opinion in part as follows:

The commission refused to permit any surcharge or change of any kind to be made in rates of the 50,000 small consumers of electricity, the residents and small office users of electricity for light and limited power, who are now and will remain under the 7-cent rate with a 50-cent minimum per month charge.

The commission likewise refused to permit any surcharge or charge of any kind to be made on suburban lines.

The commission did, however, grant a horizontal increase in the case of all of the large light and power users of electricity. A surcharge of 5 mills per kilowatt-hour is granted for a period extending to the end of the present fiscal year, June 30, 1918. This surcharge will vary in percentage of increase. Those, for example, having a 5-cent rate will be increased 10 per cent for this limited period; those having a 2½-cent rate will be advanced 20 per cent, and those having lower rates will have higher percentages of advance.

The commission also granted a surcharge of 25 per cent to be added to all bills for steam and hot water heating for this season, ending next spring.

It is specifically provided that the present schedule of rates is in no wise to be considered changed; that the surcharge is granted only as an addition and to be charged as a separate item, and for the period ending June 30 next—a period which will carry the company through the heavy winter season, both as to light and heat operations, and which, it is hoped, will bridge the period of extraordinary costs of production.

The commission finds that the petitioners in their hearing on Aug. 8 proved beyond any possibility of doubt that they are facing heavy financial losses and that they are now showing heavy deficits. The commission holds, however, that the petitioners have only proved their case in so far as the cost of production is concerned, in which item coal is the largest element. The commission holds that they did not show any material increases in cost of distribution and other incidentals in conduct of the business, including collections, etc. For these reasons, if for no others, the commission finds that it would be unjustified at this time in levying the surcharge on the small consumers, whose 7-cent rates are little influenced by increased costs of coal and other production costs, and whose rates are made high to cover costs of distribution, collections, etc.

The commission includes in the list of those power and light users on whom the surcharge is granted the city of Indianapolis. It was found to be one of the largest lighting consumers in the city, and it enjoys on its large contracts a rate of approximately 2½ cents. Legal counsel of the city had extracted from the petitioners a promise that they would not ask the application of a surcharge to the municipal bill, and on this score the city made no appearance at the hearing and filed no protest or objection on any grounds to the petition for relief. The commission points out that the date of the hearing, Aug. 8, was set specifically to suit the convenience of the city's legal representatives. It holds that any agreement entered into between the city and the petitioners is not binding on the commission, and that there could be, in the working out of justice and equity, no solution except to include the city in the group of large light and power consumers on whom the surcharge is authorized. It is further pointed out that the public utility law does not contemplate, and that it specifically prohibits, discrimination as among certain classes of users of service. It further appears that notwithstanding the fact that the Merchants' Heat & Light and the Indianapolis Light & Heat companies have surrendered their Indianapolis franchises and are operating under indeterminate permits, they have continued to pay to the city franchise and gross earning taxes, and that these payments to the city, which will probably aggregate $75,000 during the coming year, will be more than double any temporary relief that is thus provided.

The commission also states that it does not in this order grant as great a degree of temporary relief as it might have done had not there been failures on coal contracts, resulting in higher coal costs for the operating companies. The commission takes the ground that it is not a court for adjudication of failures on contract, and that it will not be placed in the position of levying on consumers a tax to make good losses incident to the failure of coal-contracting and other companies to meet their contract obligations; that it does not in this order levy on the consumer a rate to absolve the coal companies of contracts or obligations, and that further relief must be sought by appeal to the courts on contracts and other points of controversy.

In making its estimates on which the decision of the commission is rendered, coal estimates are predicated on the recent prices for coal that have been set by the President. The commission by its report reveals that it has conducted independent investigations. It finds that there has come on to the public utility companies a great load caused by manufacturers, large building managers and other large users of power and light abandoning their own individual power plants. The investigation reveals that this is the result of the high prices of coal and increasing costs of labor and the scarcity of both. The result of this shifting of great industries to the central power station load has been to decrease by 3 mills the revenue per kilowatt-hour of the companies—this caused by the great increase in consumption of electric energy at the low or lowest rates, which, according to testimony, in some instances are actually "cheaper than the cost of coal itself."

Testimony in Other Cases

In testimony before the commission on other cases the following points have been made:

J. A. Browne, Browne-Mills Electric Company, North Manchester, testified that for the year ending June 30, 1914, his coal bill had been $4,836; for 1915, $6,514; for 1916, $6,815, and for 1917, ending June 30, it had been $10,104. His bills had shown a marked advance since his coal contract expired on Aug. 1. Labor and other material costs had made a distinct advance recently.

M. F. Tennis, general manager Madison Light & Railway Company, which had been obtaining river shipments of coal, said that it had been purchased at the following prices: July and August, 1916, $2.15 a ton; September, 1916, $2.25; Jan. 1, 1917, $3; March 12, $3.50, and June 1, $4.50. The company had notice last week that coal would cost $4.50 a ton delivered at the plant. He estimated that for the coming year coal at $4.50 a ton would cost $8,245 in excess of the expense for last year. His estimate of the excess cost of labor was $1,200. After questioning the witness in regard to power rates, Chairman Lewis said that the company was not charging for power on a systematic basis and indicated that this matter might receive attention later. It was also brought out that the company is operating its electric railway at a loss, but its franchise with the city of Madison compels operation of the railway.

George W. Clark, secretary Oakland City Light & Power Company, which is in the midst of the coal fields, said that on April 1 his coal bill jumped from $1.25 a ton to $2.40 a ton.

WORK OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT

"Industrial Heating as a Central Station Load" Supplements the Earlier Study of Electric Furnaces—3000 Uses for Electricity

The Society for Electrical Development has issued part two of its study of "Industrial Heating as a Central Station Load." It deals with the utilization of the heat of electrical energy. It supplements the specific applications of the electric furnace set forth in part one, "Electric Furnaces." The intention was to include in the second part applications other than those mentioned specifically in the first part.

"The society is publishing the information because," it says, "while it feels there is a large and profitable load to be obtained from the applications of the electric furnace, it recognizes that the greatest opportunity for the central station to acquire its ideal load lies in the bigger and broader field of general industrial heating on account of its magnitude as well as the large variety of industries to which it already has been and can be applied. . . . Study the proposition with all of the facts before you, and if in doubt consult the manufacturers of the apparatus involved. This is of the utmost importance."

A revised edition of the booklet "More Than 3000 Uses for Electricity" has been issued by the society, as the first edition was exhausted.

UNIVERSAL MILITARY TRAINING IS NEEDED, SAYS H. M. BYLLESBY

"We Must Never Again Be Caught So Completely Unready to Defend Ourselves," Says Utility Operator

Henry M. Byllesby, founder of H. M. Byllesby & Company, makes the following statement on "The Great Issue":

The supreme and overshadowing issue before the American people is to win the war and secure the safety of our national life. Nothing must stand in the way of this. We face the most cruel, the most desperate and the most efficient foe that ever waged war, one whose preparation for the conflict was complete to the last detail. The war was of the Kaiser's seeking. He planned and prepared for it for years, and he was the only one ready when the crisis came. Therefore, at the start, being ready, he swept everything before him, and now at the close of the third year his line is strongly intrenched in the west, where he holds Belgium and a considerable part of France, and so far the Allies have not been successful in dislodging him, except here and there. In the east, Russia is falling back. The Kaiser holds in brutal subjection ravished and ruined Serbia, Montenegro and a part of Rumania. If the drive of the Central Powers continues, they will soon tap the wheat and oil fields of the Black Sea country and then their two great needs, food and oil, will be relieved. This will enable Germany to continue for a long period.

To win, the Allies must smash Germany's line, and to do this requires a greatly superior force to that needed to hold an intrenched position. Let us not deceive ourselves or be misled by fake overtures of peace that shall in any way abate our activity. This war must be fought out and be won or lost in Europe. It will require desperate fighting on land, on sea and in the air. Without us the Allies cannot win. We must quickly grasp and fully meet the situation. Our response must be prompt and to the utmost of our ability. We must strengthen the lines. Should Russia be out of it, we must go in with 1,000,000, 2,000,000 and perhaps 3,000,000 men. We must prepare for this. We must have a plan ready, one as big as the project and one that will produce results quickly.

In brief, we must immediately provide for universal military training as a definite and fixed policy of this government, and as soon as the cantonments now under construction have been vacated by the men called by the selective draft they must be filled with other men to receive intensive military training for at least six months. If they are not then needed, send them home and fill the quarters with younger men coming on, until every man physically fit, as he reaches a given age, shall undergo this training. If the country needs him, he can respond efficiently. If it does not, he is a stronger and better man for the training. It will help him to fight his own battles in life with greater success; it will give him a stronger physique and a better conception of what our government means and of his obligation to it. Training these young men in advance will add immeasurably to their efficiency as soldiers and teach them how to protect themselves in action. Such training will save tens of thousands of lives that otherwise would be sacrificed and billions of money that otherwise would be wasted. Our boys must meet trained and seasoned soldiers, and the only way to do this successfully is by thorough training, and only by so doing will our boys have the opportunity to meet the foe upon equal terms. We must never again be caught so completely unready to defend ourselves. Our motto must be, "Safety first and safety always."

N. E. L. A. COMMITTEE URGES CORRESPONDENCE COURSES

Every Company Should Begin Immediate Active Preparation by Appointing an Educational Director, Says Chairman F. R. Jenkins

Fred R. Jenkins, chairman committee on education of salesmen of the Commercial Section of the National Electric Light Association, has issued a notice calling attention to the educational courses. It says that every company should begin immediate active preparation by appointing an educational director, that a number of subscribers are women who are preparing themselves for every possible emergency, and that the unprecedented existing conditions demand that others prepare themselves to assume the duties of those called away.

The notice calls attention to the three courses, practical electricity, commercial engineering, and accounting. The course of ten lessons in practical electricity, inaugurated recently, has already over 500 subscribers. The lessons are written without the use of advanced mathematics, the object being to give a practical knowledge of the fundamental principles of electricity and magnetism and the construction and use of electrical apparatus.

Conducted for almost two years and with over 1500 subscribers the commercial engineering course comprises seventeen lessons. It is intended to assist the student to keep pace with the rapid development in applications of electricity and thereby to enable him to prepare himself for advancement.

Accounting courses are two in number, elementary and advanced. A course of seven lessons covers elementary bookkeeping and accounting. The advanced course is a highly specialized course in electric public utility accounting, consisting of thirty-six lessons, covering all phases of bookkeeping and accounting, applicable to large and small companies, following closely the N. E. L. A. classification of accounts and the most approved practices. The elementary course already has over 300 subscribers. This course or its equivalent is a prerequisite for enrollment in the advanced course.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Gas & Electric Securities Company Two-Year Notes.—An issue of $1,000,000 collateral trust 6 per cent two-year notes, dated Sept. 1, is being offered by the Gas & Electric Securities Company at 98¼.

Electric Bond & Share Company Stock Issue.—Stockholders of the Electric Bond & Share Company, New York, have authorized an increase in stock from $16,000,000 to $20,000,000, of which $2,000,000 will be common and $2,000,000 preferred.

Professor Clewell to Lecture at Yale.—Prof. C. E. Clewell of the University of Pennsylvania will deliver on Sept. 10 his fourth annual lecture on the fundamental principles of natural and artificial factory lighting before the junior students in electrical and mechanical engineering in the summer term of mechanical technology at the Sheffield Scientific School of Yale University. This year's work during the four weeks' summer term is under the direct supervision of Prof. Herbert L. Seward of the mechanical engineering department and under the general supervision of Profs. Charles F. Scott and L. P. Breckenridge, heads of the departments of electrical and mechanical engineering at the Sheffield Scientific School.

Electric Vehicle Appreciated in Siam.—J. L. Hansen of the Siam Electricity Company of Bangkok, Siam, on a visit to this country informed the National Electric Light Association that his company has a fleet of five electric vehicles, two of which have been in use since 1904. The thirteen-year-old vehicles are used for lamp delivery, while the larger trucks are used by wiremen and for various other purposes. The vehicles are operated successfully by unskilled natives and are found to be as economical in Siam as in this country. The Siam Electricity Company uses rice husks in place of coal, and this fuel is obtainable in almost unlimited quantities at small cost. In the event that there should be a shortage of rice husks, the company keeps an oil tank for reserve fuel, but it is rarely needed.

Continue Special Military and Naval Instruction at Massachusetts "Tech."—Plans have been prepared at the Massachusetts Institute of Technology for continuation of special military and naval instruction after the school year opens this fall. During the summer a large amount of extra work has been conducted by the regular staff on a volunteer basis in preparing specially qualified students for war service of various kinds. Co-ordination of instruction is now required as the regular sessions approach, and to meet the conditions in sight instructing forces have been reassigned and the whole campaign for the coming year made as definite as possible. The special instruction required is likely to be continued far into the future. In aeronautics alone there are three special schools of enlisted men under way—the Cadet School of Army Aeronautics, the Cadet School of Naval Aeronautics and the School of Ensigns. Soon after Sept. 1 it is expected that from 600 to 700 men will be taking these special courses. For the School of Ensigns the instructors are naval officers; the other two schools are instructed by the institute regular technical staff and by such military and naval instructors as are required in addition. The various courses include instruction in radio, internal combustion engines, signaling and other subjects directly related to war work. Valuable work is being done at the institute also in preparing qualified students to become engineers in the enlarged merchant marine, and a number of graduates are now attached to navy yards and shipbuilding plants.

Reorganization of Reading Properties Approved in Pennsylvania.—As a result of mergers approved by the Pennsylvania Public Service Commission, the Reading Transit & Light Company has come into the ownership of properties that supply electricity for power and lighting in Reading, Lebanon and adjacent territory, and also becomes the owner of virtually the entire electric railway system of Reading and its suburbs, heretofore operated under leaseholds. One of the features of the change is that hereafter the Reading Transit & Light Company will operate as an electric railway company instead of a leasing company. By the mergers just approved the Metropolitan-Edison Company will acquire the properties of the Metropolitan Electric Company, the Edison Electric Illuminating Company at Lebanon and the Lebanon Valley Electric Light Company (which operates in Myerstown), subject only to a prior lien of $2,726,000 first mortgage bonds of the Metropolitan Electric Company. This new company will have a controlling interest in the Pennsylvania Utilities Company of Easton, which furnishes electric light, power and gas in that city, Phillipsburg, N. J., and adjacent territory. Thus the Metropolitan-Edison Company will cover one of the most highly developed and widely diversified industrial sections of the country, serving a population of about 300,000. The Metropolitan-Edison Company in turn will be controlled by the Reading Transit & Light Company through ownership of its common stock. The mergers will make Reading one of the greatest electrical centers in the East. A 33,000-volt transmission line to connect the West Reading power plant with the Lebanon plant is being built at a cost of $60,000, and its completion in the near future will mean one of the largest power services in eastern Pennsylvania. A number of large power systems then will be run together, and any one of them will be able to use the surplus capacity of another in an emergency.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Institute of Radio Engineers.—A paper on "Oscillating Audion Circuits," by Prof. L. A. Hazeltine, of Stevens Institute of Technology, Hoboken, N. J., was read at a meeting of the Institute of Radio Engineers on Sept. 5.

Baltimore Section, A. I. E. E., Elects Officers.—The officers of this section for the coming year are as follows: Chairman, J. B. Whitehead; secretary-treasurer, L. M. Potts; executive committee, A. S. Loizeaux, A. T. Clark, W. H. Swift, R. C. Faught, F. A. Allner, C. G. Edwards and H. B. Stabler.

Convention of Purchasing Agents.—The annual congress of the National Association of Purchasing Agents, which is to be held in Pittsburgh on Oct. 9, 10 and 11, is taking on an importance that is impressing itself nationally. For the first time since the association's organization five years ago the importance of participation in a "clearing house" of information has impressed itself not only on the members but also on the firms and industries with which they are connected. The details of the convention are being worked out by Robert F. Blair, Pittsburgh Gage & Supply Company, chairman of the convention committee. E. L. McGrew of the Standard Underground Cable Company is the National association president.

Association of Iron and Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., Sept. 10 to 14. The papers to be presented are as follows: "Safeguarding Electrical Equipment," by Walter Greenwood; "Heroult Electric Furnaces," by Walter C. Kennedy; "Factors Relating to the Economical Generation and Use of Electric Power in the Steel Industry," by Brent Wiley; "Central Station Power Supply to Iron and Steel Industry," by Joseph McKinley and R. L. Baker; "Electrical Reversing Blooming Mills," by R. D. Nye; "Electric Drives for Reversing Rolling Mills," by D. M. Petty; "Fuel Economy by Co-operation in Establishing a Better Practice in the Operation of Stokers and Boilers," by J. G. Worker; "Turbo-Generators," by R. H. Rice; "Manufacture, Selection and Use of Carbon Brushes," by E. H. Martindale; "Grab-Bucket Coal Hoists Operated by A.-C. Motors with Dynamic Braking and Regenerative Braking," by James Farrington and R. H. McLain, and "Tool Steel Gears and Pinions for Mill and Industrial Service," by E. S. Sawtelle. Standardization committees on motors, control and crane standardization will also meet.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. E. Firth, safety engineer for a number of years with the Midvale Steel Company, has resigned to take a vacation of indefinite duration.

G. W. Johns, formerly with the Boonton (N. J.) Gas, Light & Improvement Company, has been appointed manager of the Newton (N. J.) Electric & Gas Company.

Lloyd R. Hunt has resigned as superintendent of the Lexington (Ky.) light and water department to become connected with the Tallassee Power Company, Baden, N. C.

Monroe J. Frankel has been appointed gas and electrical inspector of Louisville, succeeding the late R. M. Parks. Mr. Frankel had been chief deputy under Mr. Parks.

L. W. Dickson, formerly of the new-business department of the Denver (Col.) Gas & Electric Light Company, is now assistant new-business manager of the Empire District Electric Company at Joplin, Mo.

William J. Lynch has been appointed general manager of the Quebec Railway, Light, Heat & Power Company, Ltd., of Quebec, Canada. Since the death of H. G. Matthews Mr. Lynch has been acting as treasurer and comptroller of the company.

J. E. Van Hoose has been appointed superintendent of the Lexington (Ky.) light and water system, to succeed L. R. Hunt. Mr. Van Hoose was formerly in charge of the city light and water department of Tupelo, Miss., and also that of Brandegee, Ala.

L. J. Lemen has been appointed new-business manager of the Massillon (Ohio) Electric & Gas Company. Mr. Lemen was previously connected with the new-business departments of the Montgomery Light & Water Power Company and the Toledo Railways & Light Company.

Frank I. Hardy, formerly general manager of the Chicago, South Bend & North Indiana Railway, has been appointed general superintendent of the Northern Ohio Traction & Light Company, Akron, Ohio. Mr. Hardy has been engaged in electric railway work for the past twenty years.

W. M. Tait, former superintendent of power with the Glenwood Light & Water Company, Glenwood Springs, Col., has resigned his position with that company and accepted a position with the Intermountain Railway, Light & Power Company as superintendent and manager of the Scottsbluff (Neb.) district, including Scottsbluff, Gering, Bayard, Melbeta and Minatare.

Thomas Ewing has resigned as Commissioner of Patents and will again practice law in New York City, as he did prior to his appointment as commissioner. Mr. Ewing was an assistant examiner at the Patent Office from 1888 to 1890. From 1891 to 1913 he practiced law in New York, making a specialty of patent law, during which time he solicited some well-known patents, including the Sprague patent on a multiple-unit system of electrical train operation.

C. L. Brower, formerly connected with the Oregon Power Company, has been appointed chief engineer of the Prosser plant of the Pacific Power & Light Company, succeeding H. C. Holt, resigned.

E. V. Pryor has been appointed new-business manager of the Jefferson City (Mo.) Light, Heat & Power Company, succeeding Norman Olson. Mr. Pryor was formerly connected with the Illinois Traction Company in campaign work.

M. L. Derge, former general superintendent of the Trumbull Public Service Company, Warren, Ohio, succeeds J. E. Harsh as general manager of the Salina (Kan.) Light, Power & Gas Company. Prior to going with the Trumbull company Mr. Derge was superintendent of the Milligan Company of Elyria, Ohio.

R. B. Stearns, vice-president of the Milwaukee Electric Railway & Light Company, has been elected senior vice-president in charge of operation of the Bay State Street Railway Company, Boston, Mass. Mr. Stearns, who is a graduate of Purdue University, became assistant manager of the Milwaukee property in 1911 and vice-president a few months later.

J. E. Harsh, general manager of the Salina (Kan.) Light, Power & Gas Company, has assumed a similar position with the Lincoln (Neb.) Gas & Electric Light Company, General Manager George A. Montgomery being in poor health. Mr. Harsh was treasurer and new-business manager of the City Light & Traction Company of Sedalia, Mo., before going to Salina.

Duncan T. Campbell, vice-president and manager of the Scranton (Pa.) Electric Company and past-president of the Pennsylvania Electric Association, has suffered a severe bereavement in the death of his wife last week. Expressions of sympathy have been extended to him, for Mrs. Campbell shared with her husband a great popularity in the industry, particularly throughout Pennsylvania.

Harold V. Bozell, for the last nine years professor of electrical engineering at the University of Oklahoma and who has been spending the past year at Yale University on Sabbatical leave, has resigned the Oklahoma position to become assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. Professor Bozell was very active in engineering affairs of a public nature in Oklahoma. He was representative of the A. I. E. E. on the Oklahoma committee on industrial preparedness and also chairman of the Oklahoma board of preparedness directors. Besides, he was one of the organizers of the Oklahoma Electric Railway Association, of which he served for a number of years as secretary. He was graduated from the University of Kansas in 1908. For the last nine years he has been connected with the University of Oklahoma where he built up the department of electrical engineering from a small beginning.

Dr. H. B. Shaw, former dean of the School of Engineering of the University of Missouri, has been appointed supervisor of the Doherty cadet school. Dr. Shaw's duties will include the selection of men from the universities of the country to become Doherty cadets, to supervise the courses and to recommend cadets for regular posts in the organization. He will make his headquarters, it is expected, in Toledo, Ohio. Dr. Shaw was born in Winslow, Me., in 1869. He was educated in the private schools of Tarboro, N. C., and was graduated from the University of North Carolina in 1889 with the degree of A. B. He received a B.C.E. from there in 1891 and an A.M. from Harvard in 1894. From 1889 to 1913 he served as instructor, assistant professor and professor in mathematics, surveying and drawing at the University of North Carolina, Harvard University and the University of Missouri. At the latter university he was dean of the School of Engineering and director of the engineering experiment station at the time of his appointment to the Missouri Public Service Commission in April, 1913. Dr. Shaw has written several engineering books and has had much practical engineering experience. He was with the Phoenix Iron Company in 1892, in street railway work in Jersey City, N. J., Newark, N. J., and Pittsburgh in 1896, and did miscellaneous engineering work from 1899 to 1913, having been consulting engineer for Columbia, Mo., and having designed the water and light plant and had charge of other engineering projects for the University of Missouri. He also suggested and developed the engineering experiment station (1909-1913) and was editor of the Engineering Experiment Station's series of bulletins.

Obituary

Henry J. McGregor, superintendent of the Tacoma (Wash.) light and water department, died recently following an operation for appendicitis. Mr. McGregor had charge of the La Grange end of the construction of the Tacoma municipal power plant.

Robert J. Watson, head of the four-year apprenticeship trade course at the Westinghouse Electric & Manufacturing Company, died recently at Wildwood, N. J. Mr. Watson had been in the employ of the Westinghouse company since the fall of 1901, starting as a time clerk.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

TENDENCY NOTICED TO SELL UNDER CURRENT MARKET

Situation Largely Brought About by Advance Price-Increase Announcements, Permitting Heavy Stocking

Even with the volume of trade and the difficulty in supplying it, competitive conditions still prevail in the electrical supply jobbing field. In a number of staples prices considerably under the current market prices are constantly being quoted. Not long ago a prominent jobber in the East sold a large quantity of flexible conduit that he had in stock at considerably less than $70. At the time it would have cost him to buy it from the manufacturer in carload lots in the neighborhood of $69. To be sure, he made a profit on the transaction over the cost to him, because he had laid in the stock at a low price, but he had to replace that stock at a cost of a few hundred dollars above what he sold it for.

It is not difficult to see that if such a program is carried out consistently in the end the net result will be a loss. So long as the market is advancing it is possible to show a net profit and still sell under the current market, but when the market settles down or a decline comes, then all of these profits are wiped out and more besides. By selling at a price that shows a profit on the cost to buy at the time of the sale the seller takes the safest course.

Of course, this situation has largely come about through manufacturers announcing price increases far in advance. Jobbers are urged to lay in heavy stocks, and then in order to turn over their stock as rapidly as possible the jobbers are willing to take a price under the current market.

In fact, in some sections of the country it is possible to buy from contractors certain indoor wiring supplies at prices considerably under what the manufacturer is now quoting for carload lots.

JAPAN AS A FACTOR IN WORLD'S LAMP MARKET

Exports of Incandescent Units Amounted to $335,000 in 1916, with Prospects of Surpassing $1,250,000 During Current Year

Prior to the outbreak of the war in Europe in the summer of 1914 the largest single factor by far in supplying the foreign trade of the world with incandescent lamps was Germany. American tungsten filament lamps were beginning to compete, but not in a large way. In fact, up to that time the greatest efforts had been made to force the foreign lamps out of the American market on a quality as well as price basis. This was virtually accomplished at the beginning of the war.

Soon after hostilities commenced, however, Germany found it impossible to continue her foreign trade except with her allies and contiguous neutral nations. For that reason a foreign lamp trade of an unusual value of from $3,000,000 to $5,000,000 was suddenly thrown upon the market.

American manufacturers soon realized this opportunity, and as a result the exports of incandescent lamps manufactured in the United States have grown from around $500,000 annually to more than $2,000,000 annually since the war began. At the same time the Japanese manufacturers began to take steps to cultivate this market, and consequently the Japanese exports of incandescent lamps in 1916 amounted to $335,000, and in the first four months of the current year to $420,000, or at the rate of over $1,250,000 for the current year. These figures are to be compared with no exports and with imports of $150,000 in the year previous to the war.

The one difficulty the Japanese lamp manufacturers have had was in the supply of filaments; practically all of these used to be imported. Now, however, only a small fraction of the filaments used are imported. Large factories have been constructed, and the Japanese manufacturers are now in a position to supply their own filaments.

As the figures show, the progress made by the Japanese lamp industry has been very great. With the modern factories that have been constructed and with exceedingly cheap labor, it is conceivable that Japanese lamps may dominate the foreign markets in the same way that German lamps did three years ago and previously. It is interesting to note in this connection that American capital is interested in the Japanese lamp industry, and it is reasonable to believe that it is playing no insignificant part in developing this industry.

NEED EXISTS FOR WATCHING DEBTORS' INVENTORY ACCOUNTS

Eastern Banker Uges that Stock Be Carried More on Basis of Normal Cost Rather Than on To-day's High Prices

A warning to distributers was issued recently by one of the prominent bankers of the East to watch the inventory accounts of debtors. Inventory accounts, in the opinion of this man, are being carried too high. Prices are much higher to-day than under normal conditions, and therefore a normal stock would cost considerably more. To carry this stock on the books at the higher figure is the evil to which attention is called. In fact, it is urged that this stock be carried on a normal cost basis.

The reason for this warning is to be found in the uncertainty of future prices. Present-day stocks may depreciate over night in value should the market take a sudden slump, and consequently any borrowing done on the basis of an inventory using present prices would place both the creditor and the debtor in an unfortunate position should a sudden decline occur.

SWEDISH ELECTRICAL TRADE SHOWS A RAPID GROWTH

Consular Report States that Scandinavian Manufacturers Are Diligently Engaged in Seeking New Markets

In the Swedish electrical industry, represented by several important concerns, there have been consolidation, increase of capital, rapid growth, and the diligent seeking of new markets, it is stated in a recent report to the Bureau of Foreign and Domestic Commerce, by Consul General H. W. Harris.

One of the principal companies, now increasing its capital stock from $7,236,000 to $8,040,000, ranks as the largest of its kind in northern Europe. Its products include generators, motors, transformers, and equipment for light, power and electric railways. It has built generators up to 25,000 hp. Its net earnings in 1916 were $3,343,000, as compared with $1,238,000 in 1915 and $589,000 in 1914.

CHARGING INTEREST ON OVERDUE ACCOUNTS

Credit Men Not Yet Ready to Adopt Practice, Fearing Boomerang of Possibility of Having to Act as Banker to Trade

While but few electrical concerns make a practice of charging interest on overdue accounts, considerable attention is being given to this practice by the industry. The feeling exists very strongly that something ought to be done to bring the delinquent debtors up to scratch. Credit men, however, are on the whole distrustful of the interest-charging practice. By charging interest on overdue accounts the distributer lays himself open to becoming a banker for his trade. Of course, the jobber is practically acting as banker already for many of the smaller customers, and much of the material sold to this class is paid for after it is sold, or, what amounts to the same thing, on a consignment basis.

Those who are charging interest on overdue accounts, as far as can be learned, are satisfied with the results. It is found, however, that the creditor must be firm and impress upon the debtor that prompt settlements are expected and that interest is charged merely as a penalty.

This matter was discussed at some length by members of the National Electrical Credit Men's Association at the Boston convention, but the members declined to adopt a resolution that it was the sense of the meeting that the interest-charging practice should be followed.

For the manufacturer, particularly under existing conditions, it would probably not be difficult to institute the interest-charging plan. For the jobber, however, it would be more difficult because of the class of customers.

METAL MARKETS CONDITIONS

Trading Is Still Dull Waiting for Announcement of Government Prices

There was little trading done in the various metals last week. Buyers and sellers alike are awaiting the government decision on steel and copper prices.

There has been a large amount of copper buying held back and it is believed that as soon as prices are fixed a brisk demand will develop. It is expected that the government price will be announced in the course of a week or ten days, and that a price between 20 cents and 25 cents, probably 22.5 cents, will be fixed.

Refineries are now obliged to draw on surplus stock owing to previous mining curtailment. Should buying pick up on a large scale soon, it is not impossible that a shortage of copper might develop.

Quotations fell off again on electrolytic copper, and on Tuesday nominal prices were as follows: September, 25.62½ cents; October, 25.25 cents; November, 24.75 cents; fourth quarter, 24.5 cents.

NEW YORK METAL MARKET PRICES

	Aug. 27	Sept. 4
	£ s d	£ s d
Copper:		
London, standard spot	120 0 0	120 0 0
Prime Lake	27.00 to 28.00*	27.00 to 28.00
Electrolytic	26.00 to 26.50*	25.50 to 25.75
Casting	25.50 to 26.00*	25.00 to 26.00
Wire base	32.00 to 33.00*	32.00 to 33.00*
Lead, trust price	11.00	10 50
Nickel, ingot	50.00	50 00
Sheet zinc, f.o.b. smelter	19.00	19 00
Spelter, spot	7.92½ to 8.30	8.05
Tin, Straits	61.50	61.25
Aluminum, 98 to 99 per cent.	44.00 to 46.00*	43.00 to 45.00*

OLD METALS

Heavy copper and wire	24.00 to 25.50	23.00 to 24.00
Brass, heavy	15.00 to 15.50	15.00 to 16.00
Brass, light	12.50 to 13.00	12.00 to 12.25
Lead, heavy	9.00 to 9.25	9.00 to 9.25
Zinc, old scrap	5.50 to 6.00	5.50 to 6.00

*Nominal.

THE WEEK IN TRADE

DEMAND for supplies from normal quarters is slowly dropping off, with the exception of the South, where a building revival has started. Utility purchasing is at a low point and under present prices and financial conditions will probably continue to be small. With the exception of some line construction materials, prices are remaining firm and steady. Deliveries are becoming better. Collections appear to be holding up well, but the optimism on this point is not so strong as it was a few weeks ago.

NEW YORK

Government contracts continue to hold the prominent place in the market for electrical goods. Outside of cantonment construction building is at a minimum. There is a movement on foot, however, to stimulate building, and a generally optimistic feeling exists. It is expected that in spite of high prices a number of apartment houses and office buildings will be begun shortly. Utility buying is growing smaller, and all repairs and maintenance work are being kept at a minimum. In fact, practically the entire normal market for electrical goods has fallen considerably below its recent level. There is, however, no indication of a break in prices. Prices are very firm, and in some instances, particularly in the line of equipment, higher prices are noticed.

Deliveries generally are better and consumers' stocks are as a result diminishing. Purchasing is being made more as necessity arises.

Export demand continues, but it is now very difficult to supply this market because of shipping conditions.

CROSS-ARMS.—Deliveries are very poor on both Pacific Coast and Mississippi points shipments. Labor disturbances, particularly those connected with the I. W. W., have hurt production on the coast. Shipbuilding and government orders have held back deliveries to the regular trade. Prices advanced on Aug. 25 about 5 per cent.

INSULATORS.—Glass insulators have advanced on the average about 5 per cent. Some sizes did not change at all, while others increased more.

TRANSMISSION POLES.—There is a strong tendency toward an advance for chestnut poles. Farmers and small local interests are disposed to hold out for higher prices, with the result that the jobbers are paying more to-day than they did three weeks ago.

POLE AND LINE EQUIPMENT.—There is little business except for government work. Central stations and railways are making their ordinary requirements for maintenance and improvements as small as possible. Nor are there any large extensions in this territory. Cantonment work, however, is going along briskly. Deliveries are somewhat better than they were. Hardware can now be had in three to four weeks where a short time ago three months or more were required for a shipment. Other items, particularly cross-arms, are still on very long and uncertain deliveries. Deliveries have not improved sufficiently, however, to warrant local jobbers in cutting down on stocks.

WIRE.—Prices are unchanged for current deliveries, although buyers who are anticipating their requirements for January and later deliveries are receiving the advantage of the lower price on copper. Business in small sizes is practically at a standstill, while in the larger and circular-mill sizes a nice demand is experienced. Railroads are buying considerably, but the light and power and railway utilities are cutting their purchases down. Telephone and telegraph requirements are nil. There is quite a bit of pick-up work in the local market, such as repairs, work done over and replacement. This work, which is largely industrial, has resulted in a big volume of small orders.

INCANDESCENT LAMPS.—Industrial consumers are reducing the volume of stocks on hand and buying more

from hand to mouth. For a time, when the lamp delivery situation was critical, these buyers laid in a three months' stock. Now that the manufacturers have increased production beyond the consumption power of the market, local agents have bettered their stocks and buyers are depending on these local stocks and those of the manufacturers. There is a considerable demand from the government for cantonment purposes. The requirements of each are from 15,000 to 20,000 lamps. Practically 40,000 lamps will be required in the New York territory to equip the cantonments at Syracuse and Yaphank.

TOYS AND HOLIDAY SPECIALTIES.—There is already a big volume of orders being placed for the Christmas trade. Indications are that Christmas-tree battery outfits are selling best at present. These will be used with toy transformers on house-lighting circuits. The difficulty in obtaining ornamental glass bulbs has led to the development of celluloid ornamental cases to go over plain glass bulbs.

COLLECTIONS.—There was little difference noted in the amount of collections during the month of August, the total holding up as well in the jobbing line as in previous months.

ELECTRIC RANGES.—Many inquiries are being received from Scandinavian countries, but little business is developing from this direction owing to the transportation problem. For this reason it is doubtful if any trade will come from these neutrals for some time to come.

MOTORS.—Great Britain has added electric motors up to ½ hp. to the list of prohibited imports. This is not applicable, however, to motors imported under license.

SPLICING SLEEVES.—Several large orders for seamless copper splicing sleeves have recently been filled for the Colorado Power Company, Lehigh Navigation Electric Company and the Harwood Electric Company by Edwin G. Hatch, New York.

SOOT CLEANERS.—The Vulcan Soot Cleaner Company, through its New York representatives, has recently closed a contract for soot cleaners for ninety-eight boilers for a group of electric light, power and railway companies controlled by the H. L. Doherty Company. Besides the efficiency of mechanical soot cleaners as compared with hand blowing, the continually rising price of coal is also accountable for the present volume of business.

CHICAGO

In the Middle West business is steady. The price-fixing program at Washington is perhaps the topic of greatest interest in business circles. If this question is settled soon in a satisfactory manner, better business is expected. Regardless of the character of the decision, however, normal fall purchasing is expected to prevail.

The month of August was ahead of July for some of Chicago's prominent jobbers. With the manufacturer, however, it is reported that, especially in supply lines, the volume in August was a little less than in July. The fact that all industrial plants are busy and expect to continue so is looked upon as a good omen. Normal stocks of industrial lighting goods were laid in to anticipate demands from this source. There has been no change in prices. Credits and collections are still satisfactory.

MOTORS AND TRANSFORMERS.—It is reported that one prominent company was overstocked and is turning some of its stock of material into money for extensions.

APPLIANCES.—Owing to campaigns conducted for central stations by one manufacturer sales of appliances have increased. None of the campaigns was extraordinarily successful but all were satisfactory.

LABOR.—The strike which has involved the Springfield (Ill.) central station assumed threatening proportions again on Labor Day, when 2000 strike sympathizers wrecked a number of street cars and attacked the gas and electric company's office.

COAL.—The State Council of Defense of Illinois is continuing to urge industries and individuals to purchase and store coal now rather than take chances on not being able to get it in midwinter.

SMALL LIGHTING SETS.—The Universal Motor Company of Oshkosh, Wis., reports that its business in small engine-driven lighting sets has increased 200 per cent over 1916 and a 100 per cent plant extension is being made to take care of orders. Some of the increase is government business.

QUANTITY PRICES.—W. N. Matthews & Brother, Inc., has adopted a unique plan for granting quantity prices in connection with the sale of its new "Matthews holdfast adjustable" and its line of lamp guards which have been on the market for some time. The holdfast adjustable will sell for from 60 to 45 cents, depending upon the quantity ordered. As it is a companion article to the Matthews holdfast lamp guard, it has been decided to give the customer the benefit of quantity prices if a quantity of lamp guards and adjustables are purchased and shipped at the same time. For example, the best price on adjustables is obtained when lots of 1000 are ordered; the best price on lamp guards is obtained when 1000 are ordered. If a customer has use for 750 lamp guards and 250 adjustables, the order can be combined and the minimum price will be obtained on each article. A higher price exists on each of these articles in 100 lots than in 1000 lots, but this price is better than the price in lots of ten. By combining sixty lamp guards and forty adjustables, the price on 100 lots can be obtained.

BOSTON

Business in the jobbing trade continues fair, but with a tendency to fall off in lines affected by the slackness of the building industry. On the whole, business is better than jobbers anticipated a few months ago. Prices are about the same, though it is rumored that advances are likely to take place in the domestic appliance field about Sept. 15. Reports on collections vary, some jobbers stating that these are poor and others that credits are good. A strong tone of optimism as to the prospects for fall business is voiced by a representative Boston jobber, who expects, however, some reduction in the rate of business increase along with an excellent total volume of trade. In few lines are there signs of improved deliveries. For the present there is not much chance of factories accumulating stocks of staple material. Government demands continue to be brisk in many classes of electrical material. The central station appliance business is exceedingly good and an early acceleration of preholiday trade is expected. Electrical manufacturers are working at night in some departments. Draft and enlistment have unquestionably affected the production situation, but in the jobbing, contracting and retail fields the labor shortage is less marked. That part of the electrical contracting business associated most closely with the wiring and furnishing of fixtures for speculative building for both residence and apartment-house work has been gradually decreasing in the past six months, as those from whom the builders secured their loans have gradually been tightening up in this respect, making it very difficult for the speculative builder to obtain funds. The industrial side of the contracting business continues excellent and the prospects are good for the next six or eight months.

MOTORS.—Since the middle of August a decrease in the heavy influx of motor orders is apparent. Deliveries and prospects for a reduction in prices do not appear to be in evidence, and on some lines prices tend to stiffen somewhat. Government business is very properly taking the precedence and a much larger volume of this class of trade is anticipated for the near future.

DRY BATTERIES.—The volume of business is increasing, largely owing to demands for high-quality products rather than to the requirements of the war. Deliveries are rather slow. It is not believed that the government is a large buyer of dry cells, although some equipment of this class is used in Coast Guard signaling service with low-voltage incandescent lamps and special reflectors.

ELECTRIC RANGES.—The volume of trade is at present rather spotty, with a general opinion among central stations that the range business is likely to pick up considerably this fall. Deliveries are at present improving,

and in Boston a good stock of ranges is on hand. Prices have not changed lately, nor are any further price movements anticipated. The high cost of coal is being featured in sales arguments and will undoubtedly stimulate range sales.

LUMINOUS RADIATORS.—Prospects for fall trade are unusually good in view of the high cost of coal that prevails everywhere.

WASHING MACHINES.—A considerable trade in these units is noted, influenced by the scarcity of immigrant labor and the high cost of living. Central station trade in these equipments appears very promising in connection with the fall campaign.

ELECTRIC SIGNS AND BILLBOARD LIGHTING.—As yet the war has had little or no depressing effect on the business of representative dealers. Considerable loss in outdoor advertising space has been noted in connection with the national prohibition legislation, but the gap has been filled with other good business. The supply of materials and equipment has been a serious problem, even at very high prices. Sign dealers and equipment men are at present operating on very close margins and as yet no concerted movement has been made to pass the increased cost over to the advertiser.

RUBBER-COVERED WIRE.—Prices tend to sag off somewhat at present.

INCLOSED FUSES.—Prices stiffened somewhat during the past month, but no further increases are in sight. The volume of business is heavy and well maintained. Deliveries are very good and factory stocks are increasing.

SWITCHES AND CABINETS. — Cut-out switches and cabinets are behind on orders.

LAMPS.—Prices are about the same and stocks are being built up. A slightly increased demand is apparent.

LABORATORY AND METER TESTING EQUIPMENT.—Uncompleted orders are on hand which require factory production at maximum capacity to avoid congestion in output. The present year has exceeded all others in point of output, according to an authoritative source. Labor is plentiful and prices remain at the present levels. Prompt deliveries, however, are difficult, on account of the material situation.

ATLANTA

There is no apparent let-up. Business continues excellent and a number of new jobs for industrial and commerrial building are being started. Residence building shows a slight improvement over last week, but there is still considerable room for expansion in this field. Reports from cantonments in the Southeast indicate that all work is progressing rapidly. All material required to complete electrical work is on the ground, with the exception of a few distributing transformers, which deficiency is being taken care of temporarily by the various central stations supplying power to the camps.

On the whole, prices remain firm, with two exceptions, heating devices and cross-arms. Deliveries show no improvement.

WIRING DEVICES.—There is a very heavy demand and stocks are getting low. Deliveries are growing longer.

LAMPS.—Normal fall business is opening up briskly. Stocks are in very good shape and orders for stock are being shipped promptly.

CONDUITS.—Prices hold about the same. Deliveries on ¾-in., 1-in. and 2½-in. sizes are getting worse.

COLLECTIONS.—Jobbers and contractors report collections as being very good, but on the other hand manufacturers state that August receipts were away off compared to the standard of previous months. The public service companies have been pressed for immediate funds to carry on expensive extensions and meet bond interest, which, no doubt, accounts for the poor showing made for collections of large amounts at this time.

INCLOSED LEVER SWITCHES.—An active market prevails and deliveries are very good.

CROSS-ARMS.—The demand remains the same and no especial activity was noted, although the price advanced about 10 per cent Sept. 1.

DRY BATTERIES.—The demand continues strong, and some difficulty is being experienced in securing deliveries. Shipment promises have been advanced from eight days to twenty-one days.

FLASHLIGHTS.—One jobber reports his sales to date as 50 per cent. greater than his entire 1916 sales.

FANS.—There is very little activity in this line at the present time.

ELECTRIC SIGNS.—This business up to within the last few weeks has been on a par with corresponding periods of past years. Atlanta's street sign ordinance has tended to hold up any rapid development of this line, but the past week, however, has shown a substantial improvement in the way of orders placed and the increasing number of inquiries. This activity is due to the local merchants realizing the importance of bringing their names more forcibly before the military trade. Recent orders average about $600 per sign. Deliveries are good, one manufacturer promising and completing shipments in from fifteen to thirty days.

HEATING DEVICES.—The trade has been notified of an advance of approximately 10 per cent to take effect Sept. 15 on air heaters, chafing dishes and percolators. As far as can be ascertained no other appliances in this line other than those mentioned will be affected at that time.

POLE AND LINE HARDWARE.—A large volume of business is recorded; no price advance recently, and deliveries run from six to eight weeks.

SEATTLE

Northwest electrical dealers report very slight decrease of sales as compared with the week previous, due primarily to the threatened shipyard strike, which would involve more than 12,000 metal trade workers, representing fifteen unions. The strike, which would be to enforce long-pending demands for a wage increase, was ordered postponed Sept. 1 to permit a final attempt by the government to effect an amicable settlement of the controversy. The strike was to begin Sept. 5. Committees from Seattle unions will meet with the adjustment committee of the Federal Shipping Board at Washington, D. C.

Sales of electrical equipment to mills are still light owing to the strike in the mills and camps, which shows no signs of early settlement. Demand from factories is about the same as reported for several weeks past. Building and general construction give no indications of an early improvement.

FIXTURES AND WIRING SUPPLIES.—Demand for buildings is negligible, nor has the anticipated increase in demand for incandescent lamps materialized.

APPLIANCES.—Household appliances and novelties are moving satisfactorily and prices remain about the same. There has been no material increase in stocks, which are low. Buying is light, just enough to meet demands. Shipments are coming through fairly well.

CONDUIT.—The demand is increasing and prices are advancing.

CREDIT AND COLLECTIONS.—It is hard to obtain credit, while collections are satisfactory.

SAN FRANCISCO

Business was practically the same last week as in the previous week, with prices unchanged. Stocks are normal on conduit, insulated wire, sockets and outlets, and deliveries are good, but the demand has fallen off. Lamp stocks are quite fair and the demand is increasing. Bare copper wire is short. Household appliance stocks are in good shape. Sales are large and increasing. Collections for August showed a noticeable improvement, being particularly good during the last week.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	$54.90 to $61.00
Coil to 1000 ft	48.80 to 59.17
No. 12 solid:	
Less than coil	63.90 to 71.00
Coil to 1000 ft	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil	$78.00 to $104.00
Coil to 1000 ft	75.00 to 80.00
No. 12 solid:	
Less than coil	121.50 to 135.00
Coil to 1000 ft	108.00 to 130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil	List plus 10%
Coil to 1000 ft	List less 10%

Twin-Conductor

Less than coil	List plus 10%
Coil to 1000 ft	List less 10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	—10% to 12%
1/5 to std. pkg	10% to 20%
Std. pkg.	34% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	12% to +20%
1/5 to std. pkg	Net to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 30	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
¾-in. single strip	$67.50 to $75.00	$60.00 to $69.75
⅝-in. double strip	71.75 to 75.00	63.75 to 72.00
½-in. single strip	90.00 to 100.00	80.00 to 93.00
½-in. double strip	95.00 to 100.00	85.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 100 Ft.
¾-in. single strip	$75.00	$63.75
⅝-in. double strip	78.75	71.25
½-in. single strip	100.00	85.00
½-in. double strip	105.00	85.00-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size. In.	List per Foot	Size. In.	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$55.00	$24.50-$25.50	$21.50-$24.75
¼-in.—		
$40.00-$60.00	$27.00-$30.00	$23.50-$27.00

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$55.00	$27.50	$23.10-$24.75
¼-in.—		
$60.00	$30.00	$25.20-$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	3.8% to 5.8%	5.8% to 7.8%
2500-5000 lb.	6.8% to 8.8%	8.8% to 10.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net	$3.50

CHICAGO

List price	$5.00 to $6.00
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3⅛ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $34.88
Coil to 1000 ft.	21.00 to 26.52

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $37.84
Coil to 1000 ft.	27.90 to 28.38

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$15.00 to $29.00

CHICAGO

Net per 100	$22.50 to $38.25

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX. 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	List to 42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$18.00 to $20.54
1/5 to std. pkg.	13.00 to 19.24

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$10.50 to $18.00	$28.00
1/5 to std. pkg.	9.75 to 11.10	21.50

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$11.85 to $26.00	$20.75 to $30.75
1/5 std. pkg.	9.00 to 20.00	16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No. Fuse

High Grade:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade:	
Less than $10 list	List to —5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%
Low Grade:	
Less than $10.00 list	5% to —5%
$10.00 to $25.00 list	11% to 16%
$25.00 to $50.00 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	5% to +5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List.
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.54
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to +20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to 23%	18%
$2.00 to $10.00 list	20% to 23%	18%
$10.00 to $50.00 list	23% to 30%	18%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	15% to 40%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$3.10 to $3.50

CHICAGO

List price	$5.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools	$0.52
No. 18, full spools	0.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.065 to $0.6885
No. 18, full spools	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-28.35	18.96-24.30	18.01-20.25
10	29.60-39.83	26.64-34.14	25.31-28.45
8	42.40-56.49	38.16-48.42	36.25-40.35
6	72.19-89.39	64.98-76.62	61.73-63.85

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	28.63-29.89	24.54-25.62	21.35-22.50
10	40.28-41.51	34.44-35.58	29.65-31.57
8	48.84-60.13	44.77-51.50	42.95-44.77
6	70.24-82.20	63.85-75.35	57.47-60.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

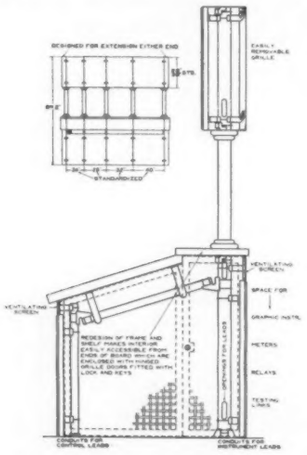
	Per 100 Lb. Net
Less than 25 lb	$42.35 to $45.00
25 to 50 lb.	40.35 to 44.00
50 to 100 lb.	39.00 to 43.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improvements in Benchboard Design

In connection with the manufacture of switchboard equipments by the General Electric Company, Schenectady, N. Y., for some of the large power plants during the last few years, various improvements in benchboards have



DETAILS OF BENCHBOARD IMPROVEMENTS

occurred to the designing engineers or have been suggested by purchasers. Designs have been completed, and the following types of benchboard of new design are standard: (1) Open type of board; (2) closed type of board, with back panels in two or three sections; (3) closed type of board, without back panels, installed near wall; (4) control bench, for installing in front of instrument and meter panels.

All types of board are designed so as to make future extension possible at either end; in fact, with this design a benchboard can be extended just as easily as a vertical switchboard.

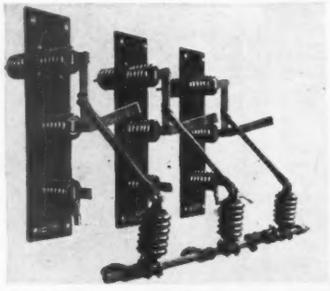
The grille panels back of the instrument sections are easily removable without the use of wrench or screwdriver. Instead of grille work back of the bench, panels are used which provide a convenient place for mounting graphic instruments, meters, relays, testing links, etc. This enables the purchaser to test these devices without interfering with the operator in front of the bench. Furthermore, with this arrangement of apparatus, all instrument leads can be brought up from the floor in almost a straight line to the instrument section without passing under the control bench, which is usually crowded. The control leads can then be distributed neatly back of the subbase, where they leave the conduits, and up to the control apparatus. This improved method not only gives a neat arrangement of wiring, but, in case of trouble, the whole system is exposed at once.

Redesign of the bench frame and a slight increase of the dimensions of the bench structure make the interior easily accessible from the ends of the bench, which are inclosed with hinged grille doors equipped with a lock and key.

Ventilating screens are provided on the front and back, running the entire length of the bench, thus preventing excessive heating from lamps and resistances. Further improvements include the use of welded instead of pivoted joints, which makes a better job and also gives a more pleasing appearance to the eye.

Remote-Control Disconnecting Switches

Construction engineers are often confronted with space limitations, making it necessary to install high-tension disconnecting switches in locations where it would be very difficult and dangerous to operate them by means of switch



THREE-PHASE DOUBLE-THROW DISCONNECTING SWITCH

sticks. For such installations it is desirable to employ the interlocked manually operated remote-control type, permitting all phases to be simultaneously opened and closed by means of a common handle, which can be installed at any desired point.

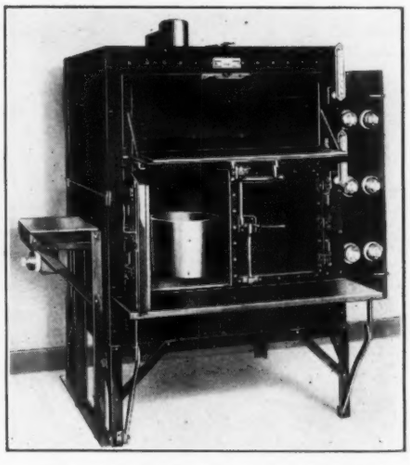
The remote-control switch will often render unnecessary the making of alterations in bus structures or building additions which would be required to secure sufficient space for a safe installation of the ordinary type. A recent development is the "urit type" switch, made in both single and double throw combinations and manufactured by the Delta-Star Electric Company of Chicago. Switches can be assembled in any combination of front and back connections. Provision is made to lock the blades in neutral or open position.

Dining-Room Floor Receptacle and Plug

A receptacle and plug for use in connecting dining-room table appliances with the source of current is being manufactured by the Hart & Hegeman Manufacturing Company of Hartford, Conn. In dining rooms where indirect lighting fixtures are used it is necessary to make the appliance connection through the floor, and this plug is designed to penetrate the rug without damage to the fabric. The plug carries two sharp pointed prongs which are insulated to their tips in order to obviate danger of ground or short circuits. These sharp points, the manufacturer states, can be inserted into the tapered hole beneath the rug very easily. Sliding shutters are used to close the openings of the receptacle the instant the prongs are removed, thus keeping out dust and dirt. This dustproof feature also makes the receptacle of value as a baseboard setting.

Electric Oven for Army Use

The electric oven illustrated herewith has been developed by the Hughes Electric Heating Company, Chicago, and submitted to the War Department of the United States for possible adoption for army cooking. This oven is designed to take care of baking, boiling and frying operations necessary in the feeding of about 150 men. It is



OVEN TO COOK FOR 150 SOLDIERS

unique in that it is the first oven to be designed to perform all of these various cooking operations at one time. The hot-plate which is bracketed to the oven will accommodate the standard United States army coffee receptacle. The oven is rated at 15 kw.

Electrically Driven Grinders for Floor Mounting

A line of electrically driven grinders and buffing lathes has recently been brought out by the Webster & Parks Tool Company of Springfield, Ohio. The grinders are provided with high pedestals for floor mounting. The smaller sizes have a shelf on the pedestal for tools, while the larger sizes have a door in the pedestal, and the interior of the pedestal provides a large compartment for tools. Heavy guards provided with connections for dust-exhausting systems cover the grinding wheels.

The motors are fully inclosed and equipped with ball bearings. Outboard bearings are also provided on the large grinders. In the smallest size grinders a 1-hp. motor is used, and a 5-hp. motor is used on the largest grinders. The motors are made by the Robbins & Myers Company, Springfield, Ohio. In addition to the direct-connected electrical outfits, the company makes a complete line of belted outfits for all services.

Amply Ventilated Floodlighting Projector

For general floodlighting purposes the Electric Service Supplies Company of Philadelphia recommends the type FL-1412 projector shown herewith, used with either "Golden Glow" or "Crystal" mirror reflector, depending on the floodlighting conditions to be met.

The body proper, including ventilator housing and door, is made of sheet steel, and wherever possible electrical spot welding is utilized instead of riveting, this resulting in a strong, rigid and weatherproof construction. The door is swung on heavy pressed steel hinges, is fitted with a rubber gasket to assure its being thoroughly watertight, and is held securely closed by a wing nut latch which will not work open.

The mirror is supported in a steel felt-lined shell and is securely held therein by means of eight segments clamping the edge throughout the entire periphery. This steel shell also supports the entire focusing mechanism as well as the incandescent lamp, so relieving the mirror of all strain.

PROJECTOR FOR POLE MOUNTING

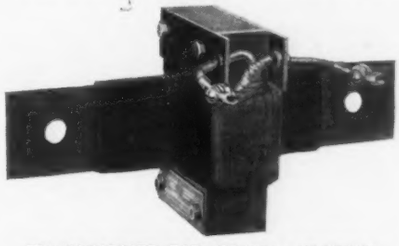
The projector, it is pointed out, is amply ventilated. On the lamp casing proper is mounted a heavy cast quadrant, this being supported in a double-jawed swiveling base. By means of this construction the lamp may be rotated in any direction or elevated or depressed at will, thus enabling the operator to train the beam accurately on any object to be illuminated. Means are provided for locking the lamp in any desired position.

Current Transformers for Tripping Breakers

Current transformers designed particularly for tripping oil circuit breakers have been developed recently by the General Electric Company of Schenectady, N. Y. They are known as the type Y-285, form A, and are furnished in ratings from 5 amp. to 800 amp. at 4500 volts or less.

Two styles are available. The first is for use up to 300 amp. and the second from 300 amp. to 800 amp. Either can be used with oil circuit breakers for tripping directly or in connection with relays. In addition to the trip coil or relay an ammeter may also be connected to the transformer, when the trip coil does not require more than 70 volt-amp. at 5 amp.

The 5-amp. to 300-amp. transformers



TRANSFORMER FOR HEAVY CURRENTS

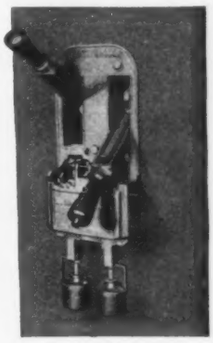
are equipped with a cast-metal base with two bolt holes for mounting on a flat surface, or by means of fittings on pipe supports. The secondary leads are supported by bushings in two small metal plates fastened with flat terminals for bolting to similar terminals on cable leads.

The higher capacity transformers for use from 300 amp. to 800 amp. inclusive are of the bus type and are supported by bolting the primary in the bus or connection bar or to the stud of the oil circuit breaker. No base is required. The secondary leads are supported by bushings in two of the metal plates which help to hold the transformer laminations in place.

Inverse-Time-Limit Attachments

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is making an inverse-time-limit attachment for direct mounting on the current-trip magnets of the overload-trip cover plates and electrically operating mechanisms of all its type F and type B automatic breakers.

The attachments for use on cover-plates of manually operated breakers are of the double-disk type and are adjustable by varying the area of the moving disk that is directly opposed to the stationary disk. On 100 per cent overload a time element of approximately five seconds is obtainable, and by adjustment this may be varied downward to zero. A longer time element



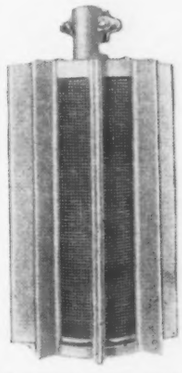
METHOD OF MOUNTING INVERSE-TIME-LIMIT ATTACHMENT

may be obtained up to approximately ten seconds by using a heavier oil than that provided with the attachment.

The atttachment for use on electrically operated breakers is of the disk-pot type. Time adjustment on this form is made by varying the opening of the valve disks as on the plunger. The use of the inverse-time-limit attachment does away with the necessity for relays where an inverse-time-limit characteristic on the overload feature is desired.

Grounding Box

A grounding box that consists of a hollow cylindrical cast-iron shell approximately 5 in. (12.7 cm.) in diameter and 12 in. (30.5 cm.) long has been brought out by the Philadelphia Electric Company, Supply Department, 132 South Eleventh Street, Philadelphia. Supported by this shell and forming part of the same casting are a number of longitudinal ribs that extend radially outward from the circumference of the cylindrical surface. The center of the box serves as a receptacle for holding a special hygroscopic compound of silicates, sodium, carbon and vegetable fiber. Connection to the ground box is made by means of a 1-in. (2.54 cm.) galvanized-iron pipe that is screwed into the top of the casting and securely fastened.



HEAVILY GALVANIZED GROUND BOX

Trade Publications

FUSES.—The Daum refillable cartridge fuses for electric light and power service are illustrated and described in a folder that has been issued by A. F. Daum of Pittsburgh, Pa.

VALVES AND JOINTS.—The Universal Valve Company of Burlington, Wis., has prepared a bulletin descriptive of its non-packing high-pressure valves and joints for steam, air, gas and ammonia.

ELECTRIC HEATERS.—The Hotpoint Electric Heating Company of Ontario, Cal., is distributing a leaflet descriptive of Hotpoint "Hedlite" heaters and is announcing an increase of price after Sept. 15.

SAFETY DISCONNECTING HANGER.—The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has prepared a bulletin supplementary to catalog B-16, descriptive of its safety disconnecting hanger.

PROTECTIVE METER EQUIPMENT.—The Metropolitan Engineering Company, 35 Vestry Street, New York City, is distributing bulletin No. 3600, descriptive of its protective service and meter equipment. This company has also prepared a bulletin descriptive of its service and watt-hour-meter protective devices.

INDUCTION MOTORS.—Bulletin No. 180 has been prepared by the Crocker-Wheeler Company of Ampere, N. J., to describe its form Q induction motor for two-phase and three-phase use, squirrel-cage type, 60-cycle operation. This motor is made in from 1 hp. to 300 hp. and is designed for constant-speed operation.

STOKER EQUIPMENT.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a bulletin giving a description of complete stoker equipment. The following items are illustrated and described: The Roney stoker, chain-grate stoker, underfeed stoker, stoker engines, forced-draft fan equipment and furnace observation doors.

MOTORS.—The Reliance adjustable speed motors with armature shifting design for direct current are illustrated and described in bulletin No. 1014, now being distributed by the Reliance Electric & Engineering Company, Cleveland, Ohio. This bulletin takes into consideration the mechanical details, quotations from users, starting and reversing equipment, and photographs of actual installations.

WIRE AND CABLE.—The Belden Manufacturing Company of Chicago has issued catalog No. 7, relating to electric wires, cables and cordage. The company's factory and general offices are at Twenty-third Street and Western Avenue. The catalog referred to contains a most useful compilation of information for those in the trade or electric construction. Many tables and convenient data are given.

SHADES AND REFLECTORS.—The Faries Manufacturing Company, Decatur, Ill., has issued its twelve-page, illustrated bulletin No. 25, giving revised prices of metal shades and reflectors. The forty cuts show this company's numerous styles of shades and reflectors, with patent collar lock holders, and in each case is given the watt capacity of lamp to which it is suited. The shades are made of steel and aluminum, usually finished in green enamel on the outside, with an inside finish of frosted aluminum for some styles, and for others of porcelain enamel or aluminum white enamel. The frosted aluminum finish was originated by this company. The reflectors comprise the parabola of different sizes and the half-shade, made of frosted steel, frosted and polished aluminum, brushed brass and oxidized copper.

SUPPLY CATALOG.—The Western Electric Company, which three years ago established a new mark among jobbers by announcing that it would issue its supply catalog every year, once again scores as a pioneer by publishing its 1918 year book in the early fall of 1917. Two reasons are given by the company in connection with this announcement. The first is that because of the popularity which its year book has attained the entire supply of 1917 books is already exhausted. In the second place, from many quarters there arose a demand for a book to be published early in September which could thus be used by buyers in placing their requisitions for fall and winter stocks. The new 1918 year book which is now being distributed to the trade follows the plan of uniform list price and basic discount inaugurated by the Western Electric Company three years ago. In addition, manufacturers' list prices are shown on certain standard lines for the convenience of any who prefer to buy on the manufacturers' discount or who desire an independent means of checking invoices. Another feature of the book which is unique among all jobbers' electrical supply catalogs is the first section of sixteen pages following the index, devoted to a listing of the company's extensive line of printing plates, window displays, stuffers, lantern slides and other forms of assistance for dealers handling Western Electric appliances. The book consists in all of 1160 pages and contains more than 50,000 items. It is what it purports to be, a real handbook of electrical supplies.

Trade Notes

GEORGE FREDERICK WALT, president Elliott-Fisher Company, Harrisburg, Pa., died on Aug. 19.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Conn., has announced that it will institute the plan of giving a quarterly bonus to employees.

THE ELECTRIC WELDING COMPANY, 220 West Forty-second Street, New York, has filed notice of increase in its capitalization from $24,000 to $250,000 to provide for extensions.

THE NOVELTY INCANDESCENT LAMP COMPANY, Emporium, N. Y., is building a new addition to its plant at St. Mary's. The structure will be about 85 ft. by 90 ft., and cost $10,000.

THE STANDARD ELECTRIC TIME COMPANY, Springfield, Mass., has had plans prepared for the construction of a three-story addition to its works on Logan Street, to cost about $25,000.

JOHN A. STEVENS, engineer, 8 Merrimack Street, Lowell, Mass., has organized a department to furnish advice and designs of factory buildings and specifications and superintendence of their construction.

THE HARTFORD FAIENCE COMPANY, Hartford, Conn., is planning for the erection of a new addition to its plant, about 45 ft. by 80 ft. The company specializes in the manufacture of electrical porcelain goods.

THE NATIONAL LAMPS WORKS of the General Electric Company, Chicago, Ill., will build a new three-story plant at Harrison and Flourney Streets, to cost about $60,000. The works will be occupied by the Illinois Miniature Division of the company.

T. M. AVERY, one of the New York City representatives of the Blaw-Knox Company, is leaving for the Pacific Coast to take charge temporarily of the San Francisco office. Edward M. Ornitz, the San Francisco representative, has joined the Engineering Corps as first lieutenant.

THE VULCAN FUEL ECONOMY COMPANY announces that its soot-cleaner business will hereafter be done by the Vulcan Soot Cleaner Sales Company, a new Illinois corporation. The new company includes the officers and directors of the manufacturing company and also Charles DeVed as vice-president and director, and Joseph Kissick, Jr., as director and general sales manager. The Vulcan Fuel Economy Company will continue its business in all other lines heretofore handled by it and certain new lines, announcement with respect to which will be made later.

THE McCARTHY DRILL & TOOL CORPORATION of Toledo, Ohio, with executive offices at 30 Church Street, New York City, has purchased the Toledo Drill & Tool Company, which has just moved into a new and enlarged fireproof two-story structure where it has arranged to turn out large quantities of high-speed drills in addition to a full line of cutters and reamers. The McCarthy corporation has added new machinery and equipment, and announces that it is now open to take on contracts and make prompt delivery for both millimeter and inch size high-speed twist drills.

W. K. PALMER, who for sixteen years past has been continuously engaged in consulting engineering practice and the head of the firm of the W. K. Palmer Company, engineers, Kansas City, Mo., has accepted a commission as major in the engineer corps of the United States Army. In consequence his practice and the business of the W. K. Palmer Company have been discontinued for the period of the war. Major Palmer organized engineer troops at the beginning of the war and has been actively engaged in military matters for some time past. He is now in Kansas City on a five days' leave from Fort Sill, Okla., for the purpose of closing up business affairs connected with his practice and the business of the W. K. Palmer Company.

New Incorporations

THE EASTERN NEVADA POWER COMPANY, Wilmington, Del., has been incorporated with a capital stock of $4,000,000 to manufacture and distribute electricity.

THE STANTON COMPANY, Cleveland, Ohio, has been organized by W. J. Mahon, F. G. Mooney, W. T. Redmond and S. T. Powell. The company is capitalized at $10,000.

THE MILLS ELECTRIC COMPANY, Lafayette, Ind., has been incorporated for $100,000. The incorporators are B. Mills, Eldon L. Lewis, H. A. Keller and C. J. Mertz.

THE EASTERN LIGHTING COMPANY, INC., New York, has been incorporated by Sidney M. Knopf, Charles H. Sellman and Joseph Daving. The company is capitalized at $1,000.

THE NEOSHE POWER COMPANY, Miami, Tex., has been incorporated by E. M. Stapleton, Oklahoma City; J. E. Parker, Oklahoma City, and Henry E. Asp, Oklahoma City.

THE KAR ENGINEERING COMPANY, INC., New York, has been organized by M. and S. Karasick and G. P. Robbins, 129 East Eighty-second Street. The company is capitalized at $125,000.

THE ECONOMY ELECTRIC DEVICES COMPANY, Chicago, has been incorporated with a capital stock of $20,000. The incorporators are Jacob Bunn, Robert C. Lanphier and Alonzo Hoff.

THE COLUMBIA AUTOMATIC STREET LIGHTING COMPANY, Boston, Mass., has been organized by Eugene S. Sullivan, Boston; William S. McNary, Boston, and Philip C. Stingel, Stoneham.

THE SPRINGDALE LIGHT & POWER COMPANY, Springdale, Ark., has been incorporated with a capital stock of $50,000. The incorporators are: G. D. Locke, F. L. O'Neal and H. L. Hughes.

THE OLIVE STREET ELECTRIC COMPANY, Los Angeles, Cal., has been organized by Seymore Thompson, Annie H. Thompson and E. Bingham. The company is capitalized at $10,000.

THE HANDY SUPPLY COMPANY, Lakewood, Wash., has been incorporated with a capital stock of $10,000 by E. H. Martindale, H. C. Martindale, F. Z. Marty, A. M. Lloyd and H. G. Vile.

THE IDAHO TRANSMISSION COMPANY, Butte, Mont., has been incorporated with a capital stock of $500,000 by M. E. Buck, A. C. Pratt and S. P. Hogan for the purpose of furnishing light, power and heat.

THE BAKER ECONOMIC TRANSPORT CORPORATION, New York, has been organized to manufacture motors, engines, vehicles, etc., by C. W. Baker, W. A. Hall, 31 Nassau Street, and J. A. Chard, 250 Fulton Street, New York.

THE BOWERS ELECTRIC COMPANY, Reading, Pa., has been organized to furnish heat, light and power The incorporators are: W. J. Martin, Topton; D. S. Martin, Reading, and S. R. Rothermel, Reading. The capital stock is $5,000.

THE ELECTRICAL PRODUCTS CORPORATION, Dover, Del., has been incorporated with a capital of $200,000 by M. L. Gatchell, L. A. Irwin and M. L. Rogers, all of Wilmington. The company proposes to manufacture electrical specialties.

THE NAMETCO PRODUCTS COMPANY, INC., New York, has been incorporated to manufacture metal and electrical supplies. The company is capitalized at $10,000. The incorporators are: M. Levin, M. Halperin and I. Krainess of 88 Walker Street.

THE LEFIRE COMPANY OF AMERICA, Wilmington, Del., has been organized by C. L. Runlinger, M. M. Clancy and Clement M. Egner, all of Wilmington, for the purpose of manufacturing, selling and dealing in and with power equipment of all kinds. The company is capitalized at $100,000.

THE DAYTONA ELECTRIC COMPANY, Daytona, Fla., has been organized by Joseph B. Garrison, Ludlę B. Garrison, V. Markham and Joseph B. Garrison, with a capital stock of $5,000. The company proposes to buy, sell, manufacture and deal in electrical fixtures and appliances and merchandise of all kinds.

THE PEARSON-MONNETTE FARM-LIGHTING CORPORATION, Dover, Del., has been incorporated by C. L. Rimlinger and F. Armstrong, Wilmington, and C. M. Egner, Elkton, Md., with a capital of $350,000. The company proposes to manufacture lighting equipment and fixtures and do business as electrical engineers.

New England States

NASHUA, N. H.—The Manchester Traction, Light & Power Company announces that it has purchased all the franchises, works, system and property of the Nashua Light, Heat & Power Company.

EAST DOUGLAS, MASS.—The W. E. Hayward Company, woolen manufacturer, of East Douglas, is building an electric plant at a cost of about $15,000. The work will involve the rebuilding of dam.

HOUSATONIC, MASS.—Work has been resumed on the new power plant of the monument mills.

MARLBORO, MASS.—Plans are being considered for the installation of a municipal lighting plant in Marlboro.

NEW BEDFORD, MASS.—Plans have been prepared by the Union Street Railway Company for the construction of a new power station. The new building, 80 ft. by 115 ft., 70 ft. high, with concrete chimney, will be erected on the company's present wharf. It will be equipped with a 30-ton crane. The Harry M. Hope Engineering Company of Boston will have charge of the engineering work.

WORCESTER, MASS.—The Fred T. Ley Company was granted permission to construct a high-tension power line from the Wachusett dam to the town limits. The transmission line is to connect the power house at the Wachusett dam with the power house of the Metropolitan Water Board at Fayville.

BRIDGEPORT, CONN.—Contract has been awarded by the Bullard Machine Tool Company of Bridgeport for the construction of a new plant, to cost about $1,000,000. The main building will be two stories, 180 ft. by 700 ft.; administration building and storage building, 60 ft. by 165 ft., two stories high; boiler house, 50 ft. by 50 ft.; power house, 30 ft. by 50 ft., and coal storage building, 20 ft. by 50 ft.

HARTFORD, CONN.—Work has begun on the erection of an addition, 40 ft. by 80 ft., to the plant of the Hartford Faience Company, to cost about $4,500. The company manufactures electrical porcelain specialties.

NEW MILFORD, CONN.—The Southern New England Telephone Company has awarded a contract for the erection of a new telephone exchange, to cost about $30,000.

Middle Atlantic States

ALBION, N. Y.—Plans have been completed by the Western New York Utilities Company for the construction of a new power dam in the town of Carlton at the location of Clark's Mills, to cost about $200,000. The proposed dam will be 70 ft. high and 406 ft. long.

ALBION, N. Y.—Plans have been completed by the Western New York Utilities Company of Medina for a new street-lighting system to be installed on Main Street when the new paving is completed. A system of conduits will be installed in the business portion of the city and the county square.

BINGHAMTON, N. Y.—The erection of a new 33,000-volt transmission line from the new power station of the Binghamton Light, Heat & Power Company to a substation on Noyes Island has recently been completed.

ELMIRA, N. Y.—At a meeting of the board of directors of the Corning Light & Power Company it was decided to build an auxiliary electric light and power generating plant in Corning. The new plant will be on Chestnut Street near Tioga Avenue. The plant will have two powerful electric generating units.

LOCKPORT, N. Y.—Plans have been completed by the United Paper Board Company for the construction of a power plant, to cost about $200,000. Work, it is understood, will begin at once on the proposed plant.

LYONS, N. Y.—The Niagara, Lockport & Ontario Power Company is contemplating an extension 99 ft. by 151 ft., to its local power house.

MECHANICVILLE, N. Y.—A petition has been presented to the City Council by the taxpayers on North Main Street asking that an ornamental lighting system be installed on that thoroughfare.

MEDINA, N. Y.—L. S. De Graff, E. Carlton Smith and De Lancy Rankine have bought the Tonawanda Power Company from the Niagara Falls Power Company.

NEW YORK, N. Y.—The Fifth Avenue Coach Company, it is reported, is contemplating the purchasing of equipment for its new motor truck plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—The contract for the installation of heating, lighting, ventilating, refrigerating apparatus and other power equipment for the Commonwealth Hotel, Times Square, New York City, has been awarded to the General Electric Company.

NEW YORK, N. Y.—The Pennsylvania Railroad Company has awarded the contract for electrical equipment for the new hotel now being erected at Seventh Avenue and Thirty-third Street, New York City, to the Westinghouse Electric & Manufacturing Company of East Pittsburgh.

NEW YORK, N. Y.—The New York Telephone Company is reported to be considering issuing $25,000,000 in capital stock to provide funds for extensions and improvements and to take up outstanding indebtedness. The company has applied to the Public Service Commission for permission to issue this additional capital stock.

NIAGARA FALLS, N. Y.—Work has begun by the National Electrolytic Company on the construction of a heating plant on the hydraulic canal basin.

OGDENSBURG, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Sept. 12, for the erection of a new smokestack at the power plant of the St. Lawrence State Hospital, Ogdensburg. E. S. Elwood is secretary.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is building an extension to its distribution system in the Buffalo Road west of the city. It consists of a three-phase line carrying about 4000 volts.

SALAMANCA, N. Y.—The Cattaragus Union Telephone Company has filed notice of increase in capital stock from $50,000 to $75,000, the proceeds to be used for extensions and improvements.

SYRACUSE, N. Y.—Plans have been prepared for the construction of a new shop and car barn, 75 ft. by 150 ft., for the New York State Railways Company, to be erected at Burnett and Fairview Avenues. H. G. Throop is engineer.

TROY, N. Y.—The power house of the Wynantskill Power Company on the Geer estate was recently destroyed.

BAYONNE, N. J.—The Safety Insulated Wire & Cable Company, First Avenue, Bayonne, has been granted a permit for the erection of a one-story extension to its plant.

BORDENTOWN, N. J.—The City Commissioners have awarded the Public Service Electric Company a five-year contract for street-lighting, which provides for extensions to the lighting system on the main streets and the installation of new lamps of the Mazda type to replace the arc and incandescent lamps now in use.

DOVER, N. J.—The Wharton Furnace Company has contracted with the New Jersey Power & Light Company for energy to operate compressors, pumps, hoists and other equipment at its mines. The power company will extend its 11,000-volt transmission line to the mines of the company, a distance of about 1 mile.

NEWARK, N. J.—Bids will be received by the committee on public buildings of the Board of Freeholders until Sept. 12 for improvements in the penitentiary at Caldwell, including the installation of a heating and ventilating system in the women's section, new piping for power house, tunnel piping and improvements in the steam fittings in the main building. August L. Lacombe is chairman of board.

PERTH AMBOY, N. J.—Plans have been prepared by the Lehigh Valley Railroad Company for the construction of a power house, 50 ft. by 100 ft., one story, at its local shops, to cost about $40,000.

ROCKAWAY, N. J.—The Empire Steel & Iron Company is making extensions and improvements to the electric power plant at its Mount Hope mines.

TRENTON, N. J.—Plans are being considered by the Public Service Corporation for improvements and extensions to its local plant on Brunswick Avenue, involving an expenditure of about $200,000. A site has been purchased adjoining the station for the proposed extension.

TRENTON, N. J.—Plans are being considered by the City Commission for the installation of ornamental lamps in Broad, Market, Warren, State and Willow Streets and Clinton Avenue. At the present time there are 88 lamps in this district. The new plans provide for a total of about 306 lamps in the same territory.

WESTWOOD, N. J.—The Board of Public Utility Commissioners has granted the New York Telephone Company permission to extend its lines and system in Westwood, in accordance with an ordinance passed by the borough officials.

BELLEVILLE, PA.—The Union Light, Heat & Power Company has made application to the Public Service Commission for permission to operate in a section of Union Township.

EDWARDSVILLE, PA.—The Delaware, Lackawanna & Western Railroad Company is planning to install a coal breaker at its local plant, to be equipped for electrical operation. Energy will be supplied by the Woodward Power Company.

HARRISBURG, PA.—Plans have been completed by the Harrisburg Railways Company for the construction of a new substation.

HARRISBURG, PA.—The City Council is considering plans for extensions to the street-lighting system, which provide for the erection of new arc lamps of 2000 cp. in a number of city streets and also for new 60-cp. incandescent lamps in various parts of the city.

LANCASTER, PA.—Work has begun on the construction of the new plant of the Fidelity Electric Company of Lancaster to cost about $30,000. L. V. Wright has the contract.

LEBANON, PA.—The Lebanon Valley Iron & Steel Company has completed the installation of a new 500-kw. converter, Westinghouse type, to provide for increased capacity. The Edison Electric Illuminating Company, Lebanon, will furnish the service.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Drying Machine Company for the construction of a new power house at its plant on Stokely Street.

PHILADELPHIA, PA.—The Department of Public Health and Charities is taking estimates on the construction of a power house to be erected at Thirty-fourth and Pine Streets.

PHILADELPHIA, PA. — William R. Dougherty is estimating on plans for the erection of a power house at Thirty-fourth and Pine Streets for the Philadelphia General Hospital.

PHILADELPHIA, PA.—The Pennsylvania Railroad Company has awarded a contract to the John N. Gill Company, 1215 Filbert Street, Philadelphia, for the construction of a one-story shop building, 56 ft. by 100 ft. and power house, 50 ft. by 50 ft., at its Girard Point plant, to cost about $42,000. The company is also asking for bids for the construction of a two-story addition to its Harrisburg shops.

PITTSBURGH, PA.—The Public Service Commission has granted the Duquesne Light Company of Pittsburgh permission to issue $3,271,250 in securities to provide for existing obligations, extensions, etc.

POTTSTOWN, PA.—Christman & Quillman of Norristown have been awarded the contract for wiring the County Home.

READING, PA.—Excavations have been finished and all materials have been received for the construction of the new hydroelectric plant at Klapperthal, on the Schuylkill River, a few miles below Reading. Construction work is now under way, and it is expected that the plant will be ready for operation soon.

READING, PA.—The Metropolitan Electric Company has completed plans for the erection of another substation of 13,000 volts capacity in the vicinity of Sixth and Bern Streets, in the northern section of Reading. The new substation will be the fourth in the vicinity of the city to be erected within a very short time.

ST. MARYS, PA.—Work has begun on the erection of an addition, 85 ft. by 90 ft., to the local plant of the Novelty Incandescent Lamp Company of Emporium, to cost about $10,000.

SOUTH WAVERLY, PA.—The Borough Council has awarded a five-year street-lighting contract to the Sayre Electric Company, covering 80-cp. lamps. The company has heretofore been furnishing service to the town.

TREXLERTOWN, PA.—The Trexlertown & Fogelsville Electric Light Company is erecting an electric transmission line between Fogelsville and Trexlertown and Breiningsville. Energy will be secured from Reading.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company has completed a new electric transmission line from Pan Mar to Highfield.

BALTIMORE, MD.—Plans have been prepared for the erection of a new power plant at the proposed new factory of the Maryland Chemical Company, to cost about $30,000.

BALTIMORE, MD.—The Homewood Amusement Company is planning to build an ice skating rink with 22 bowling alleys underneath; about 170 ft. by 65 ft., skating surface. An ice plant, heating and electrical machinery will be installed. E. C. Sandell, 3901 Brookline Avenue, is manager. Blanke & Zink, 835 Equitable Building, Baltimore, are architects.

CHARLESTON, W. VA.—A petition has been presented to the City Council by the citizens of the West Side requesting that an arc light be installed at Charleston Street and Delaware Avenue.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company is considering erecting a new 13,000-volt transmission line (11 miles long) to furnish energy in the Morgantown coal districts.

ASHLAND, VA.—The City Council is planning to install an ornamental lighting system, consisting of 38 standards. The amount available for the work is $15,324.

NEWPORT NEWS, VA.—The Newport News & Hampton Railway, Gas & Electric Company has filed a notice of increase in its capitalization from $2,375,000 to $4,000,000 to provide for extensions and improvements. J. N. Shannahan, general manager.

SPRINGWOOD, VA.—Plans are being considered by Jasper Miller of Charlotte, N. C., for a water power development to furnish electricity for a proposed cotton mill.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Portsmouth, N. H., Schedule 1454—200 ft. leaded and armored conductor cable, 4150 ft. buoy marker 4-conductor cable, 800 ft. 3-conductor portable cable, miscellaneous leaded and armored interior communication cable, 8150 ft. lighting and power portable, double conductor wire, miscellaneous leaded and armored twin lighting and power wire, 1500 ft. plain single lighting and power wire, miscellaneous single, leaded and armored lighting and power wire. Brooklyn, N. Y., Schedule 1454—18,500 ft. 14-22-26 conductor, interior communication cable, 39,700 ft. leaded and armored telephone cable, 1,600,000 ft. plain flexible double conductor wire, 18,000 ft. plain single conductor wire; Schedule 1453—15,000 ft. new code twin lamp cord, 16,000 ft. rubber covered wire for 600 volts and less, 8000 lb. weatherproof wire on reels. Application for proposal blanks should designate the schedule desired by number.

North Central States

ALMA, MICH.—The Central Michigan Light & Power Company is erecting a new power plant on the Pine River at Alma. The building is to be 60 ft. by 80 ft. Two turbines will be installed. The cost of the plant is estimated at $250,000.

LAKEVIEW, MICH.—Electricity generated at the hydroelectric plant at Morley will soon be distributed in Lakeview by the Universal Power Company.

ROGERS, MICH.—A new water system is being planned for the power plant of the Rogers City Light & Power Company. H. M. Stark of Detroit is engineer.

UBLY, MICH.—The contract for the construction of the new water power and lighting plant has been awarded to Joseph Donaldson. The building will be 34 ft. by 40 ft.

VASSAR, MICH.—A 75-hp. engine is being installed in the municipal electric-light and water-works plant.

WOODLAND, MICH.—At an election to be held Sept. 11 the proposal to grant the Thornapple Gas & Electric Company of Hastings a franchise to supply electricity in Woodland will be submitted to the voters. Gas is now used.

CINCINNATI, OHIO.—The Union Gas & Electric Company has secured the contract for installing boulevard lamps on Central Avenue and Third Street. The specifications call for 87 lamps on Central Avenue and 12 on Third Street.

CLEVELAND, OHIO.—The Cleveland Switchboard Company is planning to erect a new factory, 80 ft. by 140 ft., at 2925 East Seventy-ninth Street.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Sept. 14 for switchboard, oil switches and reactors for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

MASSILLON, OHIO.—Work will commence shortly on the installation of the new lighting system in the residential section of the city, according to reports.

FLEMING, KY.—The Cornettsville Coal Company is contemplating the construction of a new power plant. J. W. Montgomery is president.

PADUCAH, KY.—The City Commissioners have instructed John K. Hendrick to prepare an ordinance submitting to the voters a bond issue for the enlargement of the municipal electric light plant. The commissioners propose to enlarge and equip the plant so that electricity can be supplied for all purposes.

WHITESBURG, KY.—W. C. Daniels of Monica is contemplating building a new power plant in East End, Whitesburg, to cost about $25,000.

ELWOOD, IND.—The Indiana General Service Electric Company, which furnishes electrical service in Elwood, Muncie, Marion, Alexandria and Hartford City, has filed a petition with the Public Service Commission asking permission to purchase the property of the Marion (Ind.) Heat & Light Company and the Muncie (Ind.) Heat & Light Company and to consolidate them with the Elwood Company.

INDIANAPOLIS, IND.—Contracts have been awarded by the Pennsylvania Railroad Company for the construction of new reinforced concrete shops at its Irvington works, near Indianapolis. The buildings will include a 30-stall roundhouse, machine and repair shops and power plant.

MONGO, IND.—The Farmers & Merchants' Light & Power Company, recently incorporated with a capital stock of $500,000, contemplates the installation of electric power plants in Northern Indiana and Southern Michigan. It is proposed to erect the largest plant on the St. Joe River, near Colon, Mich. J. L. Hawk is president and Eli Z. Hawk secretary and treasurer, both of Mongo.

DE KALB, ILL.—An investigation of De Kalb's street lighting is being made. The old lamps now in use here will be sold, and it is probable that a new system will be put in at a later date.

KOHLER, WIS.—Contract has been let to the Kelly Construction Company, Eau Claire, for the installation of an ornamental lighting system to cost $5,886.

MADISON, WIS.—The City Council has authorized the Wisconsin Telephone Company to lay underground conduits on University Avenue and Brook Street.

MILWAUKEE, WIS.—The bond issue of $750,000 for electric light bonds has been approved by Charles B. Wood, Chicago, for additions to the Blue Mound sanitarium.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has awarded the contract for the construction of a new power station, 60 ft. by 90 ft., to the Northwestern Bridge & Iron Company of Milwaukee. The proposed plant will have a generating capacity of 6000 kw. The Fargo Engineering Company of Jackson, Mich., is consulting engineer.

NEW ULM, MINN.—Bids will be received at the office of the city clerk, New Ulm, until Sept. 27, for furnishing and installing a deep-well pump-head starting apparatus, including electrical equipment, and laying approximately 440 ft. of water mains. Specifications may be obtained upon application to A. J. Mueller, superintendent of electric light and water works department.

ST. CLOUD, MINN.—At a special election held in the village of Albany it was voted to sell the municipal electric light and power plant to the Union Light & Power Company of St. Cloud for $12,000.

WALKER, MINN.—The Village Council has passed an ordinance granting a franchise to M. D. Stoner and T. H. Croswell to erect and maintain an electric-light and power plant in the village of Walker for a period of 15 years, subject to the approval of the voters.

WORTHINGTON, MINN.—Orders have been placed for two new high-pressure boilers for the municipal electric power plant. Work on the new plant will begin in the fall.

DUBUQUE, IOWA.—The Eastern Iowa Electric Company has petitioned the Board of Supervisors for a franchise to build transmission lines from Dubuque to Dyersville, New Wine, Luxemburg and Holy Cross.

READLYN, IOWA.—A franchise has been granted to Tegtmeier Brothers for an electric light and power plant.

WEST UNION, IOWA.—A meeting of the Board of Supervisors will be held Sept. 11 to consider granting a franchise to C. Miller & Sons for an electric lighting plant. Theo. Miehe, chairman.

PARKVILLE, MO.—Bids are being asked (date of closing not decided) by the president of Park College, Parkville, for the construction of a new power house. Smith, Rea & Lovitt, Finance Building, Kansas City, are architects.

STANLEY, N. D.—Plans are being prepared by the Stanley Electric Lighting Company for the construction of a new power house. R. F. Wherland is manager.

UNDERWOOD, N. D.—Preparations are being made by the Central Power Company for the construction of a new power plant at Bitumina and the erection of an electric transmission line from Underwood to Turtle Lake. The company will supply electricity to a number of towns in McLean and adjoining counties.

DUNBAR, NEB.—The city is to vote on a bond issue of $7,500 for an electric lighting plant.

OMAHA, NEB.—The power plant of the Ideal Pleating Company in the Brown block, at Sixteenth and Douglas Streets, was destroyed by fire. The loss is estimated to be $1,500.

YORK, NEB.—The contract for electric wiring of the new high school has been awarded to the Public Service Company of York, at $3,450.

CONCORDIA, KAN.—Bids will be received by the Board of Education until Sept. 11 (extension of date) for the construction of a high school, to cost from $55,000 to $60,000. Separate bids to be submitted for electric wiring, heating and plumbing. W. E. Hulse & Company, First National Bank Building, Hutchinson, are architects.

LEEDS, KAN.—Preparations are being made for the installation of an engine and generator, directly connected, at the municipal farm, for which bids have been received.

Southern States

HARLEM, GA.—J. J. Zachry is contemplating rebuilding lumber mill and electric-light plant recently destroyed by fire.

JACKSONVILLE, FLA.—Preparations are being made by the City Commission to extend the municipal electric-lighting service to South Jacksonville for use of the government shipyards. It is proposed to erect a 6600-volt cable from the substation to the Hillyer-Sperring-Dunn Company's plant on South Side, now under government control.

ALBANY, ALA.—Improvements to cost $10,000 are being made here on the power house of the Alabama Power Company. A new Corliss engine is being installed and a new generator. The capacity will be increased 40 per cent.

GADSDEN, ALA.—The Alabama Power Company will furnish the power for operating Gadsden's municipal plant.

GADSDEN, ALA.—Arrangements are being made by the city of Gadsden to equip the pumping station of the water-works system for electrical operation. The equipment will include a 2100-gal. per minute pump; two 1750-gal. per minute pumps for filling reservoir; also 200-hp., 150-hp., two 40-hp. and 10-hp. motors. Bids have been asked for installing machinery. The city will maintain an auxiliary steam plant. Ernest Smith is city engineer.

MOBILE, ALA.—The Mobile Electric Company, it is reported, is contemplating extension to its electric transmission system, to cost about $20,000, in the Pinto and Blakely Islands district.

GREENWOOD, MISS.—The Yazoo & Mississippi Valley Railroad Company, it is reported, is planning to build a new power house, 26 ft. by 54 ft.

DE RIDDER, LA.—T. S. Reed of Beaumont and others are considering rebuilding the local electric-light plant, recently destroyed by fire, causing a loss of about $15,000.

SENTINEL, OKLA.—At an election held recently the proposal to issue $5,000 in bonds for the installation of an electric-light plant was carried.

BIG LAKE, TEX.—Henry Japson has purchased the Big Lake Townsite, and it is reported will construct a water-works system, electric-light plant and make other municipal improvements to the town.

DALLAS, TEX.—The Western Union Telegraph Company and the Mackay Telegraph Cable Company are planning to place their wires in underground conduits in the business district.

DALLAS, TEX.—The City Commission has under consideration a plan for an entirely new system for lighting the streets of the city which provides for the erection of hundreds of electric lamps in different sections of the city now without street-lighting service. The street-lighting system, it is said, will be operated under a meter system when the new franchises are accepted.

SINTON, TEX.—The municipal electric-light plant, which was recently destroyed by fire, will be rebuilt. New equipment, including a new engine, generator and other equipment, will be installed.

Pacific and Mountain States

EVERETT, WASH.—The City Commissioners have closed a deal for 100 acres at the Horseshoe Bend in the Sultan River, which includes about 1 mile of river bank, for a power site.

GOLDENDALE, WASH.—The Pacific Power & Light Company has filed a petition with the Board of County Commissioners of Klickitat County asking for a franchise to construct, reconstruct, maintain and operate transmission and distributing lines for transmitting electricity for light, power and other purposes for a period of fifty years on certain county roads, streets and public highways in Klickitat. Roy E. Crooks, County Auditor.

INDEX, WASH.—Preliminary work has been started on the construction of a municipal light plant for the city of Index, Wash. Bids will be received shortly for furnishing pipe for the system. G. N. Miller, engineer.

PASCO, WASH.—The Pacific Power & Light Company at Pasco will build a new central switching station for a 66,000-volt system which will be installed in Pasco. The building and equipment will be erected about two blocks east of the municipal docks at an estimated cost of $100,000.

SEATTLE, WASH.—The Electric Sales Corporation has recently closed a contract for the installation of the Apfel electric heating system in the new Paul (Idaho) High School.

SEATTLE, WASH.—Bids will be received by C. B. Bagley, secretary of board of public works, Seattle, until Sept. 28 for furnishing air brakes, including safety control and electrical equipment, for single-truck, double and safety motor cars for division "A" of the Seattle municipal street railway.

SEATTLE, WASH.—The City Council has granted an extension of time for submitting proposals for the proposed hydroelectric plant until Oct. 5. This action was taken owing to the present uncertain bond market condition. Bids are to be submitted to C. B. Bagley, chairman of board of public works.

SEATTLE, WASH.—Plans are being considered by the Puget Sound Traction, Light & Power Company for changes in its steam heating plant at Western Avenue and Union Street and in its steam-driven power plant at Georgetown, involving an expenditure of between $400,000 and $500,000. At the Georgetown plant it is proposed to install automatic stokers, at a cost of between $200 000 and $250,000, to provide for burning coal instead of oil. Improvements similar to those proposed for the Georgetown plant will be made to the Western Avenue power station. Plans have been started, it is reported, for the construction of a five-story addition to the Western Avenue power plant, which will house a coal pulverizing plant to cost about $50,000. These changes are due to the shortage in fuel oil.

SEDRO WOOLLEY, WASH.—Contract for the construction of a power house at the state insane asylum was awarded to the Warrack Construction Company, Seattle, at $24,200. The improvement will include the construction of a 140-ft. concrete smoke-stack. George W. Lawton prepared the plans.

SPOKANE, WASH.—The contract for electrical work for the new theater to be erected by Alexander Pantogos at a cost of $150,000 has been awarded to Ne Page McKinney Company of Seattle.

SUNNYSIDE, WASH.—The City Council has passed an ordinance granting to the City Telephone Company a franchise to do general telephone business in the town of Sunnyside.

TACOMA, WASH.—The County Commissioners have granted the Puget Sound Traction, Light & Power Company a 25-year franchise to operate electric transmission lines between Tacoma and Tapps.

TACOMA, WASH.—The city of Tacoma has filed a claim for 600 cu. ft. of water per second on the Nisqually River and on Mineral Creek, and also a claim for the use of Mineral Lake for storage purposes. The claim was filed with the ultimate purpose of constructing an auxiliary electric generating station to duplicate the present plant at La Grande at a selected site on the upper Nisqually River, about 5 miles above Elbe. The City Council will be asked to appropriate a sum sufficient to divert the water from Mineral Lake into the Nisqually River in order that the plant at La Grande may handle a peak load during low water periods. The Council also has another plan under consideration for diverting sufficient water from the Nisqually River to establish a reservoir at another point and provide for the construction of an additional power plant having a capacity equal to the present municipal plant.

BEND, ORE.—The Bend Water, Light & Power Company is installing new equipment, which will increase the output of its plant by 500 kw.

FRESNO, CAL.—A. G. Wishon, general manager of the San Joaquin Light & Power Company, reports that two new hydroelectric plants on the Kern River will be placed in operation within the next thirty days.

FRESNO, CAL.—The San Joaquin Light & Power Company is planning to erect 15 miles of new lines in the Chowchilla district this fall. The company will furnish power for the Swift property and on the land of the Howard Cattle Company.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has filed an application with the Railroad Commission for authority to issue $750,000 first and refunding 6 per cent bonds. The proceeds from the sale of the bonds are to be used for additions and improvements to its system.

GRASS VALLEY, CAL.—Walter W. Bryne has completed arrangements for work at the Franklin and Ford properties, adjoining the Allison Ranch. Orders have been placed for an electric pump, a 75-hp. hoist and a ten-drill compressor.

LOS ANGELES, CAL.—The Hill Street Improvement Association is considering installing an ornamental lighting system on that thoroughfare similar to the one which will be constructed on Broadway.

REDWOOD CITY, CAL.—The Pacific Gas & Electric Co. has just been awarded the contract for furnishing Camp Fremont with electricity. The contract calls for the installation of nearly 20,000 lamps. The company has already started work at the camp, and substations are being built, rights-of-way established and the poles erected.

SAUSALITO, CAL.—An ordinance was passed granting the Pacific Telephone & Telegraph Company the right to place, erect and maintain poles, wires and other appliances and conductors for wires for transmission of electricity for telephone and telegraph purposes in and under streets, alleys, avenues, thoroughfares and public highways in Sausalito, Cal.

VALLEJO, CAL.—The Pacific Gas & Electric Company will soon file bond for $15,000 for the privilege of operating within the city of Vallejo.

BOISE, IDAHO.—The Idaho Power Company contemplates the installation of six new units at the Swan Falls plant on the Snake River, near Cuffey. The proposed extensions will develop about 8000 hp. and will cost about $500,000.

OGDEN, UTAH.—Lightning struck the Utah Power & Light Company's plant on Twelfth Street. One of the large generators was so badly burned that it will have to be replaced, according to reports.

BIG TIMBER, MONT.—The City Council has passed a resolution providing for the establishment of a lighting district that embraces the entire town, for the installation of a new street-lighting system subject to the approval of the taxpayers. The plans provide for the installation of 32 single post lamps of 250 cp., and for 41 lamps of 250 cp., to be erected in the residential district. The cost of the system is estimated at $5,300.

HARLOWTON, MONT.—Arrangements are being made for the installation of an ornamental lighting system in Harlowton, for which bids have been received.

MALTA, MONT.—The Town Council has passed an ordinance creating three special improvement districts for the installation of a street-lighting system. The cost is estimated at about $15,000.

TROY, MONT.—Electrically operated machinery, it is reported, will be installed in the mines of the Big 8 line on Callahan Creek near Troy. Energy will be secured from the plant of the Snowstorm Consolidated Company. Harry L. Day of Wallace, Idaho, has charge of the development work on the Big 8 line.

LUSK, WYO.—Bids will be received until Sept. 10 for machinery, materials, etc., for improvements to the municipal electric-light plant as follows: One 100-hp. oil engine, with piping, water-cooling apparatus and starting equipment; one 60-kva., three-phase, 60-cycle, 2300-volt generator, directly connected to engine; one 20-hp., three-phase, 60-cycle, 2300-volt alternating-current motor with compensator. For details see Searchlight Section.

DENVER, COL.—Plans are being considered for installing an ornamental lighting system on Lake Place from the Fourteenth Street viaduct to Federal Boulevard and West Thirty-third Avenue and from the Twentieth Street viaduct to the boulevard.

ROCHESTER, NEV.—It is reported that the Nevada Valleys Power Company is constructing a power line through Humboldt and Lander Counties to connect with the line at Rochester. A line is to be extended to Golconda and from there to Winnemucca and into Grass Valley.

Canada

NELSON, B. C.—The Granite-Poorman Mining Company is planning to install a new compressor plant with a capacity of 1500 cu. ft., and a 300-hp. electric motor. The present plant has an output of 100 hp. Energy is secured from the municipal electric power plant of Nelson.

VANCOUVER, B. C.—The Whalen Pulp & Paper Company is preparing to construct a shipbuilding plant. The plans for the proposed power plant provide for a 7000-kw. and a 750-kw. generating unit.

LONDON, ONT.—John A. Moody of London is reported to be in the market for a 50-in. water wheel and a Fitzgibbon marine boiler.

SMITH'S FALLS, ONT.—The by-law authorizing an appropriation of $135,000 to purchase the plants of the Smith's Falls Electric Power Company and the Citizens' Electric Power Company and also a by-law authorizing the purchase of electricity from the Hydro-Electric Power Commission of Ontario were approved by the ratepayers at a recent election.

TORONTO, ONT.—The plant of the Polson Iron Works was damaged by an electric storm recently, causing a loss of about $10,000. Two large electric cranes were destroyed, one falling against a 125-ft. steel stack, demolishing it completely. Considerable damage was also done to the machine shop.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Washington, D. C., until Sept. 10 for furnishing steel cable, phosphor-bronze rope, sheet copper, cable clips, insulating paper, etc. Blanks and further information relating to this circular (No. 1162) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Sept. 17 for furnishing steel wrought-iron or steel pipe, chain, pumps, jacks, wire, electric cable and wire, conduit, condulets and covers, gaskets, electrical fittings, trunking and capping, etc. Blanks and information relating to this circular (No. 1165) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

MADURA, INDIA.—Plans are under consideration for the erection of an electric lighting plant capable of providing 5000 private lamps, 700 public lamps and 1000 fans in Madura, India.

1,238,124. ELECTRIC HEATING UNIT; Royal E. Frickey, Redding, Cal. App. filed Feb. 26, 1916. Low-temperature gradient between the heating element and the fluid to be heated, and also to provide a heating element which is protected from oxidation.

1,238,145. ELECTRICAL REGULATING DEVICE; Gottlob Honold and Heinrich Conzelmann, Stuttgart, Germany. App. filed Sept. 24, 1914. Excitation of the dynamo is decreased to abnormally low value before the voltage of the dynamo can increase to such a value as may burn out the circuits or the lamps in the power system.

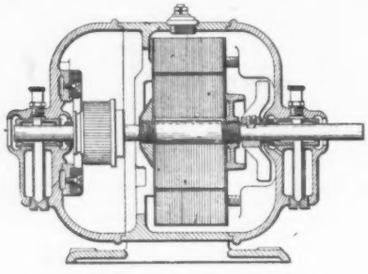
1,238,155. DIMMING SWITCH FOR PROJECTION LAMPS; Karl Kleinert, Stuttgart, Germany. App. filed Aug. 2, 1915. Improvements.

1,238,206. WELDING APPARATUS; Edward A. Shuler, Chicago, Ill. App. filed July 13, 1916. Portable apparatus for welding nails or the like to the side sheets of steel cars for securing insulation in place.

1,238,213. ELECTRIC GENERATOR AND MOTOR; Harve R. Stuart, Springfield, Ohio. App. filed April 22, 1914. Production of an electric generator or motor in which the magnetic lines of the field magnets are increased in the outside portions of the pole pieces and decreased in the central portion of the pole pieces so as to hold the magnetic center stationary or uniform and prevent the shifting of the axle of commutation.

1,238,243. FIELD-COIL SUPPORT; John L. McK. Yardley, Pittsburgh, Pa. App. filed Oct. 17, 1912. Supporting structure for field coils of machines of the interpole type.

1,238,250. ELECTRICAL APPLIANCE; Carl H. Bissell, Syracuse, N. Y. App. filed May 28, 1914. Arranged in an electric circuit for supporting and establishing electrical contact with an incandescent lamp.



1,238,290—Universal Motor

1,238,251. ELECTRICAL PROTECTIVE DEVICE; Harold W. Brown, Ithaca, N. Y. App. filed Dec. 19, 1913. Provides a relay which will operate at a predetermined volt-ampere load.

1,238,261. SWITCH; John F. Cavanagh, Meriden, Conn. App. filed Dec. 1, 1916. For controlling the circuits of an automobile, such as the signal and lighting circuits.

1,238,277. ARC LAMP; John L. Dinsmoor, Brooklyn, N. Y. App. filed April 24, 1913. For substantially eliminating or neutralizing the disturbing magnetic fields in the vicinity of the arcs.

1,238,280. COIL SUPPORT; Allan B. Field, Pittsburgh, Pa. App. filed Aug. 2, 1913. Provides a supporting and spacing member adapted for disposal intermediate to the layers of coils and having a plurality of projecting ribs oppositely inclined on opposite sides of the said member for engaging and spacing the several coils in the said layers.

1,238,290. UNIVERSAL MOTOR; Allen McR. Harrelson, St. Louis, Mo. App. filed July 8, 1915. Constitutes a motor which will be universal in the sense used in this specification at the lower and more practicable speeds of 100 to 1800 r.p.m.

1,238,292. VENTILATING CONSTRUCTION FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Aug. 6, 1915. Improves the efficiency of ventilating devices and prevents the entrance of water or other foreign substances through the ventilating openings.

1,238,304. DYNAMO-ELECTRIC MACHINE; Jan A. Kuyser, Edgewood, Pa. App. filed March 3, 1914. Provides a single short-circuited damping grid, co-operating both with the rotor core proper, with the usual damper bars and with the coil-retaining end rings.

1,238,311. CONTACT; Alexander J. Loguin, Norwood, Ohio. App. filed Nov. 29, 1911. Contacts may be so located and arranged that they may be readily inspected and removed without the use of tools.

Record of Electrical Patents

Notes on United States Patents issued on August 28, 1917

1,238,313. POLYPHASE ELECTROMAGNET BRAKE CONTROL; Benjamin McInnerney, Council Bluffs, Iowa. App. filed April 21, 1917. Provides an alternating-current magnet having an armature that is positively pivoted and is firmly seated in the same position relatively to the pole pieces in successive operations.

1,238,321. ROTOR WINDING FOR ASYNCHRONOUS MACHINES; Stanley G. Nottage, Wilkinsburg, Pa. App. filed July 14, 1915. Special reference to rotor windings for phase converters such as are employed for converting single-phase alternating-current energy into polyphase energy for the purpose of supplying polyphase electric motors.

1,238,323. SIGNAL MECHANISM; Paul E. Oswald, Los Angeles, Cal. App. filed Aug. 4, 1913. Warnings at railway crossings or other dangerous places.

1,238,336. SWITCHING APPARATUS; Clarence Renshaw, Edgewood Park, Pa. App. filed Oct. 31, 1913. Relates to switching apparatus of the group switch type, and it has special reference to the supporting structure thereof.

1,238,339. ART OF PRODUCING AND TREATING HYDROCARBON VAPORS DURING THE DISTILLATION OF THE SAME; James H. Robertson New York, N. Y. App. filed April 25, 1916. Causes electricity to pass through the confined volumes of such gases, thereby obtaining results which have been found impossible in the practice of well-known methods or processes.

1,238,345. MAGNETIC LATCH DEVICE; Frank A. Schoenle, Buffalo, N. Y. App. filed Nov. 25, 1916. Improvements.

1,238,382. ELECTRIC SWITCH; Graham Biddle, Oakland, Cal. App. filed Jan. 10, 1916. Provides an electric switch of the make-and-break operating type, wherein the same may be worked by the ordinary push-button, without the snap or noise that is characteristic of the snap switches now used

1,238,383. CONDUIT-JOINT WRAPPER; Maurice Blumenthal, Brooklyn, N. Y. App. filed Dec. 14, 1915. Absolutely waterproof and acid-proof.

1,238,406. ARC WELDER; Albert H. Homrighaus, Detroit, Mich. App. filed Feb. 26, 1915. Relates to mechanism for economically controlling power consumption in the use of electric current.

1,238,443. RECTIFIER; Henry K. Sandell, Chicago, Ill. App. filed May 1, 1914. Improvement.

1,238,459. ATTACHMENT PLUG; William C. Tregoning, Cleveland, Ohio. App. filed Oct. 2, 1914. Comprises a limited number of elements which have certain original features of construction and together constitute a new and useful article of manufacture for making an electrical connection.

1,238,460. ATTACHMENT PLUG FOR ELECTRIC WIRES; William C. Tregoning, Cleveland, Ohio. App. filed Oct. 10, 1914. Provides a plug having means to relieve the terminals for the electric wires of pull and strain, said means being mounted on the base of the plug and located within its interior in a concealed and protected position behind the screw shell.

1,238,477. SWITCH-CONTAINING ELECTRIC-LAMP SOCKET; Ernst G. K. Anderson, Chicago, Ill. App. filed Oct. 17, 1912. Improvements.

1,238,482. THIEF-PROOF LAMP-HOLDING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed Aug. 22, 1912. Improvements.

1,238,516. MOTOR CONTROLLER; Clark T. Henderson and Herbert J. Harris, Milwaukee, Wis. App. filed Nov. 2, 1914. For shunt motors.

1,238,529. BATTERY; Nicolas Kribs, Dundee, Ill. App. filed July 28, 1916. Dry-cell type.

1,238,532. PORTABLE BURGLAR ALARM; Leon Lemberg, Brooklyn, N. Y. App. filed July 22, 1916. Improved.

1,238,540. THREE-WAY PULL-CHAIN SOCKET; John F. McCarthy, New York, N. Y. App. filed Dec. 29, 1916. Improved.

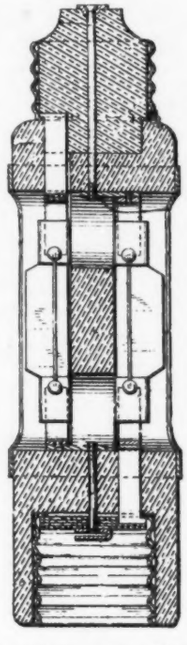
1,238,573. ELECTRICAL SYSTEM; Norman F. Rutherford, East Falmouth, Mass. App. filed April 11, 1916. Wherein a group or groups of elements may be changed from one circuit arrangement to another, each arrangement having any desired number of elements in series and parallel respectively, and preferably wherein each combination is rectangular, that is, so connected as to have the same number of elements in each series sub-group.

1,238,597. ELECTRIC SWITCH; John M. Terzich, Amador City, Cal. App. filed May 26, 1916. Provides a switch having an effective means for establishing good connection between blade and mounting.

1,238,600. PROCESS OF PRODUCING ALKALIS FROM KELP; Harlan L. Trumbull, Seattle, Wash. App. filed March 22, 1917. Furnishes compounds of potassium more valuable than those commonly derived from kelp.

1,238,628. STOP MOTION FOR LOOMS; George N. Bertrand, Stafford Springs, Conn. App. filed Oct. 12, 1914. Provides a simply constructed device adapted to close automatically an electric circuit and stop the loom, should breakage of one or more of the heddle frames or horizontal supports occur.

1,238,638. DIRECTION INDICATOR; Melvin Colby, Springdale, Wis. App. filed July 7, 1916. Automobile.



1,238,690—Fuse Plug

1,238,660. ELECTRIC DISCHARGE APPARATUS; Crosby Field-Frank, New York, N. Y. App. filed Jan. 27, 1916. Provides a simple and durable electric discharge device which will permit a very free discharge of electricity as long as the difference of potential between the terminals of the device is excessive, but will interrupt the discharge the instant the difference of potential becomes normal.

1,238,667. ELECTRIC-CIRCUIT CONTROLLER; Edward A. Halbleib and Thomas L. Lee, Rochester, N. Y. App. filed June 26, 1915. Improvements.

1,238,671. ELECTRICALLY HEATED SOLDERING TOOL; Lafayette Holcomb, Las Vegas, Nev. App. filed May 2, 1917. Provides a metallic soldering brush by which solder is applied as desired, and which may be detachably mounted in communication with the soldering receptacle.

1,238,684. ELECTRICAL LAMP LOCK; William C. Kerch, Mill Valley, Cal. App. filed July 24, 1916. Improvement.

1,238,690. FUSE PLUG; Edward D. Knott, New Orleans, La. App. filed Dec. 9, 1916. Improvements.

1,238,719. ELECTROMAGNETIC SWITCH; Burton W. Sweet and Franklin Schneider, Cleveland, Ohio. App. filed Aug. 30, 1911. Improvements.

1,238,727. ELECTRIC HEATER; Frank W. Hewitt, Arlington, Mass. App. filed May 27, 1916. Element is practically surrounded closely on all sides by heat-conducting material.

1,238,728. COMBINED LIGHTNING ARRESTER AND THERMAL PROTECTOR; Frederick R. Parker, Chicago, Ill. App. filed Jan. 19, 1917. Improved.